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# Local Government Response to Increased Flood Hazards

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of the requirements for the degree of  
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## Abstract

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The flood hazard in established urban areas is increasing. This is due to the effects of anthropogenic modification of catchments and rivers, and an increase in climatic extremes caused by global climate change, which result in an increase of the occurrence and magnitude of flooding, and the establishment of the 'catastrophe potential' cycle, which creates an increasingly vulnerable society.

The main research problem of this study is the adequacy of processes provided by the natural hazards legislation with which local authorities can respond to increased flooding risks in established urban areas. Specific objectives are: to explore potential conflicts between existing use rights under the Resource Management Act and planning for an increasing flood risk; to assess the natural hazards management framework in relation to responding to an increasing natural hazard; and to develop recommendations by which local government authorities can respond to increased flood hazards.

The approach to the problem involves a discussion of flood hazard management techniques, a review of the natural hazards management legislation in New Zealand, and a case study of local government response to the increased flood risk in Alexandra, Central Otago.

This research reveals a number of significant issues concerning the hazard management process in Alexandra, and implications for other situations. These are the effectiveness of relevant legislation, liability issues, the relationship between different levels of local government, perception of the flood hazard, the physical response to flooding in Alexandra, and the difficulties of responding proactively to increased flood hazards.

From this, many impediments to a proactive response by a local authority to an increased flood hazard have been identified. These include problems with the perception of the increase, defensibility of technical predictions, community inertia to change, and a lack of resources.

Recommendations include the provision of national direction in addressing this issue, amendment of the legislation to allow greater powers of response to local authorities, the provision of funding, and the formation of legislation concerning the effects of large dams. There is also a need for a formal mechanism to require joint hazard plans between regional and district councils to prevent the formation of a gap in natural hazards management, and a tightening of hazard avoidance legislation. Requirements for the development of community based responses to increased flood hazards are identified.

**Dedicated to the memory of  
Alan George Johnston Gibson**

**1912 - 2000**

## Acknowledgements

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## Commonly Used Abbreviations

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RMA	Resource Management Act 1991
BA	Building Act 1991
CSC	Clutha Solutions Coordinator
CODC	Central Otago District Council
ACB	Alexandra Community Board
ORC	Otago Regional Council
LIM	Land Information Memorandum
ECNZ	Electricity Corporation of New Zealand
ODT	Otago Daily Times



## Introduction

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### 1.1 Natural Hazard Management

Flooding affects more people each year worldwide than any other natural disaster (Ward, 1978), and is New Zealand's number one hazard (McKerchar & Pearson, 2001). It is the largest source of insurance damage claims from natural hazards (McKerchar & Pearson, 2001), and is estimated to have cost New Zealand \$90 million per year since 1968 (Bergham & Westlake, 2001). Nearly 100 communities, containing over two-thirds of the total population, are flood-prone (Ericksen, 1986, Bergham & Westlake, 2001). From this, a 200 year return flood can be expected in one community every other year (Ericksen, 1986).

The risk of flooding in established urban areas is increasing, both in New Zealand and internationally, due to changing natural climatic patterns, and anthropogenic modification of catchments. Nothing in nature is static, and all natural processes change and vary dynamically. Rivers meander across the landscape, periodically exceeding their banks and forming floodplains. Sea level fluctuates, and climate is a chaotic system. Where these natural processes impinge on human activities the potential for a hazard exists.

Anthropogenic modification of both land and water bodies increase this potential.

Controlling, damming or restricting the flow of rivers leads to aggregation and siltation of riverbeds, with an increased risk of bank exceedence. Protecting land from the effects of flooding encourages development on that land, which in turn creates the need for even greater flood protection schemes, in a cyclic interaction.

The management of natural hazards within New Zealand is primarily undertaken via the provisions of the Resource Management Act 1991 (RMA) (Phizacklea, 2001). This statute establishes a framework of plans and policy statements at national, regional and district levels, all of which must not be inconsistent with those at a higher level, and with the purpose and principles of the RMA (Part II). This framework controls the actions of local governmental organisations in response to natural hazards, along with the Building Act 1991, the Civil Defence Act 1983, and the Local Government Act 1974.

The RMA sets forth a process by which new development at risk from natural hazards may be restricted or controlled by local government. This involves control over subdivision (Sections 106, 108 and 220 of the RMA, and district plan land use and subdivision rules), and building consents (Section 36 Building Act), as well as development impact fees, esplanade reserve creation, and covenants.

Although this provides a process for preventing hazard prone development, in areas where development has already occurred, pro-active restrictions and hazard avoidance is clearly not possible. Established buildings and structures are protected from council modification by the existing use rights conferred by Section 10 of the RMA. Under this statute, rebuilding an existing, lawfully established structure that is at risk from natural hazards is allowed even when the current district plan rules prohibit it, provided the structure is the same or similar in character, intensity and scale as that which presently stands (Phizacklea, 2001).

In situations where this occurs, local councils are caught in a dilemma. One choice is the “do nothing” approach, refusing to protect at risk developments, and counting on individual choice and market forces generated by perception of the hazard to reduce the risk. The alternative is to take proactive steps to reduce the risk to the development. However, there are several constraints on this second option, including the difficulty of defining an increased natural hazard with enough precision to justify a response before a disaster occurs, and the social inertia to change. This can also be perceived as councils imposing the costs generated by those at risk on the entire community; in effect subsidising risk takers (Ericksen, 1986).

In either situation, potential liability exists for the affected council. The responsibility for community protection falls on Territorial Local Authorities that must balance these issues, often with limited resources, and limited community understanding of the nature of the hazard.

## **1.2 Study Purpose**

### ***1.2.1 Research Problem***

The main research problem addressed in this study is the adequacy of processes provided by the natural hazards legislation with which local authorities can respond to increased flooding risks in established urban areas.

### ***1.2.2 Objectives***

The principal research objectives of this study are:

- i. To explore potential conflicts between existing use rights (Section 10) under the Resource Management Act 1991, and planning for increasing frequency and magnitude of flood hazards.
- ii. To assess the current natural hazards management framework in relation to responding to an increasing natural hazard.
- iii. To develop recommendations by which local government authorities can respond to increased flood hazards.

These will be accomplished by conducting a case study of the local government response to the increased flood hazard confronting the community of Alexandra, Central Otago; a community struck by three major floods within a period of five years during the 1990s.

Specific topics of importance in hazard management planning to be addressed in the case study are:

- Institutional roles and responsibilities
- The response to the increased flood hazard
- Perception of the hazard
- Liability issues
- The ability of local government to plan proactively for increasing natural hazards

## **1.3 General Methodology**

### ***1.3.1 Theoretical Framework***

This report is based on the natural hazards management theoretical regime, a subset of the larger field of environmental management. It operates within an interdisciplinary framework, combining the fields of engineering, science and social science to manage the conflict between society and extreme natural events.

### ***1.3.2 Secondary Research***

Literature and archival records are investigated to provide an overview of natural hazards research theory, and the New Zealand historical and current hazard management legislation. This is used to develop a theoretical framework with which to analyse the case study findings.

### ***1.3.3 Primary Research***

A case study investigation of the Alexandra response to an increased flood risk was conducted through semi-structured interviews with key participants in the response process. These participants were either heavily involved in the formulation processes of the response, or occupied positions of importance to natural hazards planning in Local Government agencies.



## 1.4 Definitions

Several terms relating to the study of natural hazards, and the probabilistic basis of prediction are used in this report, and require definition.

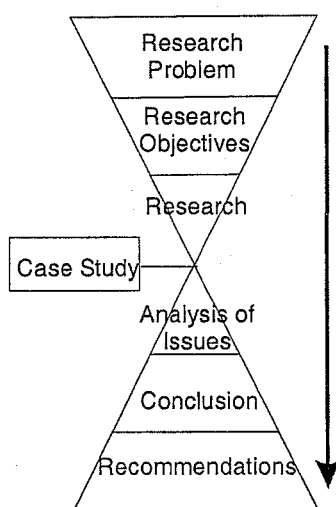
The **Annual Exceedence Probability (A.E.P.)** is the flood peak level that has a 1% probability of being exceeded or equalled in any given year.

The inverse of the A.E.P. gives the **return period** of the flood; a 1% A.E.P. flood has a return period of 100 years, while a 2% A.E.P. flood has a return period of 50 years. This is commonly, but incorrectly, termed the 100 year flood, or 50 year flood, which removes the probabilistic component from the description.

Cumecs are the standard unit of measurement for river flow. The term stands for cubic metres per second ( $\text{m}^3\text{s}^{-1}$ ).

RL, when prefixing a unit of measurement, denotes the height above relative (sea) level of the point of measurement.

## 1.5 Outline of Report Structure



**Figure 1: Report Structure.**

This report is composed of eight chapters, which together address the main research question and objectives through a process that applies the theoretical framework of natural hazards management to a specific case study, and extrapolates the findings from this into the broader context (Figure 1).

This Chapter has provided a background to the topic of study and outlined the importance of the research problem. The objectives have been defined, and a general methodology is presented.

Chapter Two reviews the current concepts of flood hazard management, including flooding as a natural hazard, flood hazard management techniques, and the potential for conflict between existing development and increasing flood risk.

The Third Chapter investigates the development of flood hazard management in New Zealand, and reviews the ability of local government to respond to increasing flood hazards under the current legislative regime of the Resource Management Act 1991 and the Building Act 1991.

The research strategy under which this report was prepared is outlined and justified in Chapter Four. Data acquisition and analysis techniques conducted within the framework of qualitative research are summarized and justified.

Chapter Five presents the Alexandra case study, where a series of major floods during the 1990s prompted Local Government action. The historical and increased flood hazards are described, as are the effects of the recent flooding and the Local Government response.

Chapter Six identifies and analyses the issues identified from the case study as important in addressing the research objectives.

A conclusion is presented in Chapter Seven, where the previous chapters are synthesised, and the research objectives are addressed.

Chapter Eight provides recommendations concerning natural hazard management in New Zealand, determined from the application of the case study in addressing the objectives.

## Literature Review

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*"the flood remains a barely mitigated evil, a hardly appreciated obstacle to progress. Indeed, as population has increased, men have not only failed to achieve means for suppressing it, or for escaping this evil, but have, with singular short-sightedness rushed into its chosen paths"*

*W.J. McGee, (1891).*

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This Chapter shows that although floods are natural phenomena, natural hazards only exist where these phenomena interact negatively with human systems. It describes and assesses the techniques by which society responds to these hazards, and shows the evolution of changing flood management paradigms.

### 2.1 Flooding as a Natural Hazard

A flood is a naturally occurring phenomenon that is an integral feature of the dynamic nature of river systems. Although a common physical event, there are a multitude of definitions within the literature. A flood can be defined as;

*"the flow of a larger than average volume of water along a river channel"* (Wohl, 2000)

This very general definition is too simple to be of use in this study, as it fails to distinguish between standard variations in river flow and potentially catastrophic events. At the other end of this spectrum is;

*A flood is a body of water which rises to overflow land which is not normally submerged.*

*(Ward, 1978, Smith & Ward, 1998)*

The implication of damage in the last three words of this definition (Smith & Ward, 1998) causes this definition to ignore those cases where floods do not affect human activities; it fails to distinguish between the extreme physical event, and the creation of a natural hazard.

A definition of flooding that moderates between these two extremes is;

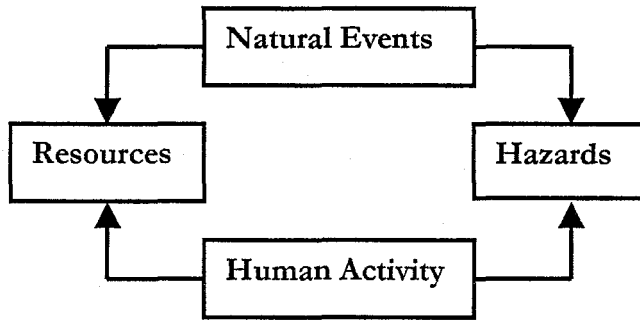
*“an extremely high river level, whereby water inundates land outside the water-confined river channels”*  
(Yevjevich, 1992)

This highlights several important factors in flooding. These are the uncommon occurrence of the event (*extremely high*), and water being no longer confined within river banks, without necessarily implying any damage or impact on society.

Flooding as a natural process has many effects beneficial to society. These include the deposition of sediments to form flat land and arable soils, replenishment of soil minerals and nutrients, removal of accumulated chemicals within the soils, maintenance of biological diversity within the floodplain, and supply of water to lakes, wetlands and soil moisture (Smith & Ward, 1998, Yevjevich, 1995). It is only when these naturally occurring phenomena interact negatively with social processes that a natural hazard is created. Where floodwaters have the potential to cause damage and loss to human activities, a hazard exists. Thus, while floods are natural events, a flood hazard is a human construct (Ward, 1978). This interaction of human activity and natural events, resulting in the creation of both resources and hazards, is shown in Figure 2.

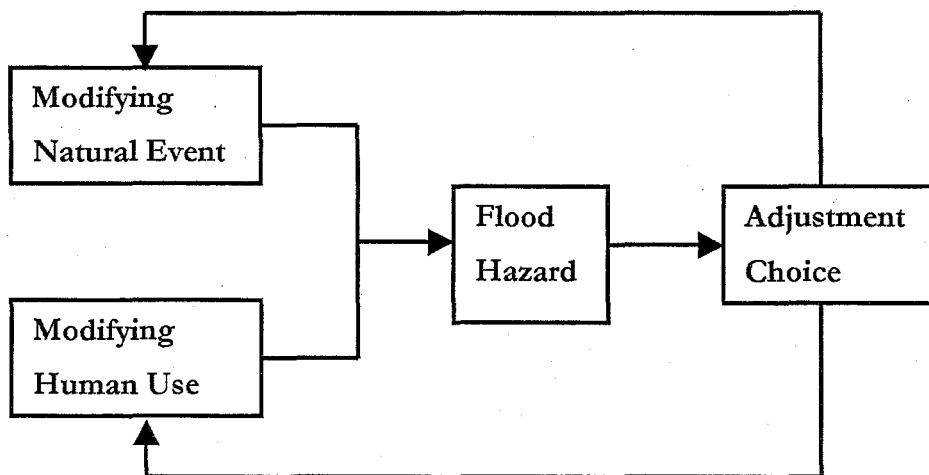
The adverse effects of flooding as a natural hazard can be divided into three categories (Moser, 1992);

- direct economic effects (property damage, income losses and clean-up costs),
- indirect economic effects (reduction in spending, loss or interruption of production),
- intangible effects (those effects difficult to assign a monetary value to, such as loss of life, injury, and emotional anxiety).



**Figure 2;** The interaction of human activity and natural events. *Modified from Burton & al., 1993.*

White (1973) defines a natural hazard as an interaction of people and nature governed by the co-existent state of adjustment of the human system, and the state of nature in the natural system. Alexander (1993) emphasises that both the natural and human dimensions of a natural hazard are dynamic and adjustable. As Figure 3 shows, the chosen adjustment may seek to change aspects of the natural flood event such as drainage, flow path or river capacity, or modify human use, through changes in behaviour and location.



**Figure 3:** Potential adjustments to a flood hazard. *From Burton & al., 1993.*

These adjustments to a natural hazard are a result of;

- i) The awareness or perception of the risk;
- ii) Commercial considerations;
- iii) The restraints acting on local government (Coch, 1995).

A demand for protection arises when a risk is perceived, but the protection provided will be limited by willingness, and ability, to pay for it (Bell, 1999).

This interaction can work in both positive and negative ways. In many situations human activities are accelerating or altering a normally benign process in such a way as to raise the likelihood of the hazard occurring, or increasing the potential damage caused. These situations, where human activities both affect, and are in turn affected by the modified natural process, are termed 'human geohazards' (Coch, 1995). In the three types of flooding identified by Yevjevich (1992), modified natural floods, which include flood events affected by humans, are seen as a major, and increasing, phenomenon. Such activities include catchment modification (deforestation, stock grazing, burning), urbanisation of upstream areas (increasing run-off) and river control works (changing patterns of erosion and sedimentation).

Recognition of the negative influence that human modification of the environment is having on natural hazard occurrence and effects has led to a paradigm shift amongst hazard management researchers and practitioners. The concept of sustainable development, and adjusting human behaviour rather than natural event systems, is now being increasingly incorporated into hazard management and planning systems.

Another factor of great importance to flood hazard management is the influence of global climate change on precipitation patterns. A major concern from this is an increase in the occurrence of extreme events, such as flooding (Easterling & al., 2000). Studies of the causes of increased flood damage in recent years have identified climatic change and social vulnerability as the controlling factors (Changnon & al, 2001, Pielke & Downton, 2000).

## 2.2 Flood Hazard Management Techniques

Societies have contended with floods since the dawn of civilisation (Laituri, 2000). This is due to the dependence of societies on the resources provided by floodplains and rivers; flat land, rich alluvial soils, and a convenient water supply.

Historically, the methods used to avoid the adverse consequences, while gaining the beneficial effects of flooding, have been a direct function of the level of technology of a civilisation (Yevjevich, 1992). Whereas less developed cultures have traditionally accepted floods as natural events, and either avoided hazardous areas or accepted the risk, technologically based cultures have sought to use these areas without risk, by dominating nature and removing the hazard. It is only relatively recently that there has been a trend away from reliance on this technocratic solution towards an approach that seeks to combine modification of both natural and human behaviour, within a socio-economic approach that accepts that complete protection from flooding is impossible and that some risk must be accepted (Smith & Ward, 1998, p33).

While several classification approaches to flood management techniques exist (e.g. Yevjevich, 1992), the dominant typology classifies adjustment responses in one of the following three ways (White, 1973, Mitchell & al., 1978, Ericksen, 1986, Bewick, 1988, Thomas, 1995a, Smith & Ward, 1998):

- **Modify flooding**  
Reduce the magnitude and frequency of the flooding process by modifying or controlling the physical system.
- **Modify vulnerability.**  
Reduce the damage potential and costs of hazard zone occupation by adjusting or controlling the human use of land.
- **Modify flood losses**  
Mitigate or share losses from a flood event with insurance, relief and Central Government financial assistance.

These techniques are described in greater detail below.

### ***2.2.1 Modify Flooding***

This approach to flood management seeks to modify the behaviour of floodwaters by the use of engineering based structural mechanisms. These can include flood diversion channels, the establishment of levees, stopbanks and water retention dams, and the channelisation and straightening of rivers. This is an anthropogenically centred approach which assumes that the achievements of technology are sufficient to remove risk from extreme natural events (Alexander, 1993).

The principles of river regulation and training were developed in Europe in the 15<sup>th</sup>-16<sup>th</sup> Centuries, but it was during the 19<sup>th</sup> Century that major efforts to regulate the entire course of major European rivers, with the aim of reducing flood-prone areas, were initiated (Rossi, 1992). Despite expectations, these methods did not always prevent flood damage. While preventing damage from frequent, smaller floods, levees were not designed for the very rare major floods that caused the most damage. Aggradation of the river bed raised the river level, increasing the frequency of flooding, while the apparent security provided by these measures encouraged intensification of development on the floodplain (Rossi, 1992). This last feature is the most important aspect of flood modification, as the increased economic potential and value of flood-prone land has resulted in an increased flood risk should the initial defences fail. Consequently, these defences are upgraded, resulting in a spiralling cycle of increasing costs, and increased risk and potential damage. This self-perpetuating problem is termed the 'levee effect' (Smith & Ward, 1998), or the 'catastrophe potential' (Ericksen, 1986).

The benefits of the structural approach are considerable; the protection of valuable land use activities (such as urban areas) and the enhancement of the economic potential of flood-prone land under normal river flow conditions (Ericksen, 1986). However, there are significant costs associated with structural flood protection works. These include the expense of initial implementation, ongoing maintenance costs, and the creation of a false sense of security that can lead to the 'levee effect'. Another disadvantage of this approach is the potential negative impact on natural values and character of riverine systems. These can be both predictable (drainage of wetlands, modification of river channels) and



unforeseen (such as the impact of the Woolston Cut, Heathcote River, Christchurch, New Zealand (Christchurch Drainage Board, 1978)). Also, it is often difficult to justify and reconcile the appropriateness of structural works with the philosophy of the sustainable management framework (Chapman, 1995).

Despite recognition of these problems, the structural approach continued in the United States of America from the late 18<sup>th</sup> Century through to the 1960s (Thomas, 1995b) with the Mississippi River providing a prime example of the 'catastrophe potential' spiral (Merritts, 2000). Despite thousands of kilometres of levees, hundreds of water control dams and reservoirs, and over 300 kilometres of river meander removed, flooding in 1993 inundated over 75 towns, killed 48 people, caused the evacuation of 54,000 more, and affected over 30 million ha of land. Total damage has been estimated at between \$12 and \$15 billion US (Merritts, 2000).

Significantly, non-structural methods of minimising flood damage are now being implemented on the Mississippi (Gruntfest, 2000, Changnon, 1998). In 1994 a federal interagency floodplain management review committee proposed that a strategy of avoiding inappropriate floodplain use, minimizing vulnerability to damage through structural and non-structural means, and mitigating damage as it occurs be adopted. This report did not call for the abandonment of human use of the floodplain, but required full consideration of the economic, social and environmental costs and benefits of future floodplain activity (Galloway, 1995).

### ***2.2.2 Modify vulnerability***

This approach seeks to reduce the losses caused by floods by avoiding the dangerous, uneconomic, and unsuitable uses of hazard-prone areas (Thomas, 1995a). This is accomplished by modifying human behaviour to reduce the exposure to flood hazards and the potential damage a flood would cause. It has been described as the most important recent development in coping with floods, as it seeks to optimise the relationship between human floodplain use and flooding (Yevjevich, 1995) by accepting flooding as an unavoidable natural event that must be accommodated by society.

This paradigm recognises that, aside from structural flood control works to protect existing development, the continuing growth of flood losses can only be contained by ensuring new development addresses both the risk of, and susceptibility to, flooding, and responds appropriately. This is accomplished by avoiding development within high-risk areas through land use planning and management, and reducing the vulnerability of activities at risk. Land use planning involves the use and implementation of;

- Zoning
- Encroachment lines
- Sub-division regulations
- Building codes
- Acquisition and relocation

By these means, developments clearly situated at risk from flooding can be modified so as to avoid establishing the catastrophe potential cycle.

The modified vulnerability approach is far more difficult to implement than the structural approach described above. Land use control requires the support of local populations (Bell, 1999) that are rarely pleased with restrictions on private property rights. There are many reasons why this approach may not work. Members of a community, including decision makers, may not understand the 'seductive' nature of the flood hazard (Pielke, 1999), and will see no reason to implement these methods. Others are comfortable with a higher risk, and will perceive controls as a restriction of their private rights. Also, the abandonment of flood prone land, or the prevention of development may be viewed as depriving the community of a valuable natural resource that could be used to produce income now, against the chance of an uncertain future event (Burton, 1965).

### ***2.2.3 Modify flood losses***

Insurance, by spreading the cost of flooding over all policy holders, imposes the losses of those using hazard-prone resources on those who do not. In effect, these other users subsidise the occupation of flood-prone areas. This has been recognised by insurance companies that refuse to insure, or charge high premiums in, areas that have recently been affected by natural disasters and which remain susceptible.

Flood insurance can be used by public administration to achieve specific objectives of land-use safety and appropriate development (Reitano, 1995), provided it is integrated with other controls, and accurately reflects the potential for damage in premium levels. This has worked effectively in the USA with the National Flood Insurance Program, which was created to transfer public flood disaster assistance costs to floodplain users. It makes Federally backed flood insurance available to property owners in communities that adopt and enforce flood loss techniques for new and existing buildings (Thomas, 1995b).

While in many cases necessary for the recovery of affected communities, financial assistance from Central Government or insurance payouts do nothing to reduce the flood hazard. By reducing the socio-economic impacts of the flood, this can actually encourage repair and rebuilding of at-risk property (Bell, 1999, Ward, 1978). It can also create an expectation that aid will be available after future disasters, and may even encourage more development, as occupiers come to understand that they can gain the benefits of flood-prone land use, but will be compensated for damage caused by disaster (Bell, 1999).

Finally, the monetary compensation of flood damage has little effect on the intangible impacts of flooding, such as the stress and fear, and the feeling of insecurity created.

### 2.3 The Problem of Existing At-Risk Development

Mitchell & al. (1978) noted (p98);

*“the dilemma of what to do about existing development in areas prone to flooding. These areas can be zoned to prohibit further development, but other adjustments are necessary to alleviate the danger of flooding and damage to existing structures.”*

This will become an increasing problem in the future of flood hazard management, caused by:

- i) Global climate change producing greater climatic extremes, including increases in high rainfall and storm events;

- ii) Increased flood frequency and magnitude, caused by anthropogenic changes to the catchment area and river channel; and
- iii) Increased development and value of land in areas that were thought to be hazard free.

The traditional attraction of riverside locations for development has long faded in developed countries, with technological advances allowing the easy transport of water to distant areas. Changing land use from intensive, vulnerable development in flood prone areas to flood tolerant uses in line with the principles of sustainable development would appear an efficacious method of adapting to the changes described above. The simplest method of implementing this is relocation of at-risk developments and activities to areas that are not at risk from flooding. Suggested examples include urban renewal programmes which replace buildings with open spaces, such as gardens and car parks (Ward, 1978), or large scale industrial relocation to council / government owned areas (Mitchell & al., 1978).

The major problems with this change of land use are the sheer cost involved, and the social and economic upheaval that would result. An established settlement has little chance of being relocated, as the huge investment in the existing infrastructure and services is not lightly abandoned, and owners are not anxious to move at their own expense (Burton, 1965, p88). The costs of relocation must be balanced against the costs of alternative measures and the reluctance of some to move (Bell, 1999), and, even if implemented, this process can only operate very slowly in an already developed area, unless large scale compulsory purchase and redevelopment is carried out (Ward, 1978). This is unlikely to be carried out by local government without external funding. There is also the issue of costs and land use control being split between different levels of government.

In addition to the severe economic constraints to resettlement and land use change, social resistance is also likely to be extreme (Ericksen, 1986), and in many cases, the inconvenience of being flooded occasionally is preferred to these costs (Bell, 1999). Cohabitation with the damage of past disasters is termed geographical inertia, either maximum (not moving), or secondary (relocating, but remaining within the risk zone)

(Alexander, 1993). Reasons for this can include a lack of awareness of the hazard, a lack of suitable alternatives, a lack of resources to adopt these alternatives, a focus on short-term objectives, high ratios of benefits to potential losses, or becoming resilient to the damages inflicted by the hazard (Alexander, 1993). This demonstrates the barriers to reducing flood damage potential in established urban areas.

This dilemma is recognised in the natural hazards literature (e.g. Ericksen, 1986, Alexander, 1993), yet no uniformly accepted methodologies for dealing with it have been developed. As succinctly stated by Burton (1965), “there is no acceptable and simple view of the flood problem”. While there has been extensive investigation into the prevention of creating new developments at risk from flooding, little study has been done on the management of existing developments threatened by increasing flood hazards. Some researchers accept that structural control measures are the only viable option for the protection of existing urban areas (e.g. Marco & Cayuela, 1992), but ignore the self-perpetuating ‘catastrophe potential’ loop that can develop. Others stress the theoretical importance of relocation and flood proofing, but admit that the realistic constraints are often insurmountable (e.g. Alexander, 1993, Bell, 1999, Gruntfest, 2000).

In Chapter Three, the history of flood hazard management, and the statutory and administrative context in New Zealand are described, including the evolution of natural hazard management since European settlement, and the present day statutory regime.

## **Flood Hazard Management in New Zealand.**

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Flooding has been a constant threat since the first European settlement in New Zealand. As such, there is a long history of organised institutional and legislative response. This will be considered in two parts; the historical development of flood hazard management, and the post-Resource Management Act 1991 (RMA) natural hazard management regime. These are reviewed to show the changing concepts of flood management in New Zealand, and to demonstrate the conflict between increasing natural hazards and existing development.

### **3.1 Historical Development of Flood Hazard Management**

The first settlements in New Zealand were established almost exclusively on coastal floodplains near major rivers. These locations provided the necessities to establish civilisation; flat land, rich alluvial soils, a ready supply of fresh water, and access to shipping. However, river works were required almost immediately to protect these settlements from flooding (Acheson, 1968). By 1870, over 1000 recorded drownings had occurred in New Zealand rivers (Cumberland, 1985) and drowning had become known as “the New Zealand death” (Waugh & al, 1997). Considerable flood damage occurred during the 1860s and 1870s, due to both the siting of settlements in inherently hazardous locations, and human impacts on the hydrological cycle, such as upper catchment clearance and the resulting acceleration of runoff, erosion and sedimentation (Waugh & al, 1997, Mosely & Pearson, 1997).

As development proceeded, landowners at risk began to form groups so as to better provide protection from flooding. River boards and trusts were formed under the provincial authorities, beginning with Hawkes Bay and Marlborough Districts in 1868

(Acheson, 1968). The first regional flood management legislation, the Canterbury Rivers Act, was also passed in that year (Mosely & Pearson, 1997). In 1876, with the reorganisation of the provincial system, these river boards were formally recognised by central government, and in some cases received government funding for projects. The River Boards Acts of 1884 and 1908 consolidated enactments relating to river board constitutions and river works (Acheson, 1968). However, the limited extent of area controlled by these early boards resulted in inefficient design works, and encouraged amalgamation of authorities to form larger, more effective bodies (Acheson, 1968). Works performed in this era helped protect urban areas subject to severe flooding, but gave little concern to the state of the catchment. By this time there had already been a major change in the character of river catchments, caused by clearing and burning of bush, mining, heavy stocking and the introduction of noxious animals (Acheson, 1968).

Flooding problems continued to be a national concern. A Royal Commission appointed in 1919 produced a series of reports on a number of South Island rivers to ascertain causes of flooding and erosion, and methods to safeguard against this. The main conclusion was that increased siltation from mining and land use change was the main cause of increased flooding. However, as there was no national authority to sponsor and guide river work, no action was taken. (Acheson, 1968, Waugh & al, 1997).

It was only in the 1930s that reports to government caused a Parliamentary Select Committee to be established to investigate flooding. This led to the passing of the Soil Conservation and Rivers Control Act (SC&RC) in 1941, then considered one of the most advanced pieces of legislation of this type in the world, bringing together soil conservation, river control and land drainage under unified control at both local and national levels (Waugh & al, 1997). It established the Soil Conservation and Rivers Control Council as the central authority, and catchment boards to plan and carry out works under this general supervision and direction. This Act allowed catchment boards to minimise and prevent damage from floods and erosion, by granting them the same powers as local authorities in order to control the flow of water, and provide river works, as deemed necessary (Acheson, 1968).

Catchment authority control, however, was not mandatory, and was only adopted in highly hazard-prone areas. By the late 1960s, significant areas of New Zealand were not

covered. This was due to concern over the wide powers given to catchment authorities, granting them the authority to set rates, control land use and restrict private property rights (Ericksen, 1986). Despite further coercion by way of the Water Soil and Conservation Act 1967, and the 1973 Amendment to this making catchment authorities mandatory, it was only during the early 1980s that almost all of New Zealand was covered (Ericksen, 1986).

The SC&RC Act 1941 promoted development and gave little consideration to the effects of intensification of development on the flood hazard. Extensive river control schemes on most large rivers from 1950 to 1980 encouraged intensified use of high quality farm land and contributed to increased post-war economic prosperity (Waugh & al, 1997). However, the effectiveness of catchment authorities in reducing the flood hazard was limited by several factors. Their efficiency was progressively eroded by the growth of both themselves and central government. By the 1980s, this, and the multi-layered dual administrative structure they operated under made even routine requests problematic, with lengthy delays (Ericksen, 1986). Also, Catchment Authorities usually adopted the engineering approach to flood hazard management, and considered that many of the existing flood hazards could only be mitigated by further river control scheme construction (SC&RCC, 1968, Ericksen, 1986). However, a strong change of views occurred in the 1970s, when river control policy affecting urban areas was formally altered to encourage territorial authorities to consider other measures (Ericksen, 1986).

This changing approach to the flood hazard also influenced land use planning and management in New Zealand. The 1966 Amendment to the Town and Country Planning Act (TCPA) 1953 required councils to 'provide against' land being used for unsuitable purposes. Development on land liable to inundation was deemed to be unsuitable, and councils were given the ability to map known flood limits. However, resistance to regional council formation, the delays in implementing operative district schemes, and a reliance on general planning frameworks over locally developed schemes prevented district and regional plans having any major influence on the adoption of land use planning and management as tools for hazard management (Ericksen, 1986). Specific requirements for this approach, and a general strengthening of planning legislation, occurred with the TCPA, 1977. This reaffirmed the need to control development in hazard-prone areas (Chapman, 1995). Regional and district schemes were both directed



to identify hazards, and identify areas where development should be restricted, determine appropriate land usage, and create rules determining land use restrictions in hazard-prone areas (Ministry of Works and Development, 1985, *in* Chapman, 1995). This was complemented by the Local Government Act 1979, which gave councils the ability to set subdivision and building codes, and allowed implementation of urban renewal and acquisition and relocation. However, several constraints prevented the enactment of these methods. They included the perceived infringement of private property rights, concern and confusion over legal and liability issues, and the predominance of the engineering viewpoint (Ericksen, 1986). Although opportunity for change existed, it was noted that “legislation by itself will not solve the flooding problem” (*ibid*, p159).

Throughout this development, the existence of a separate body charged with solving flooding problems that was set upon engineering solutions, and the reluctance of local bodies in adopting land use planning as a viable alternative, led to the situation where many of New Zealand’s urban areas have remained at risk from flooding.

### **3.2 Hazard Management under the Resource Management Act 1991**

#### **3.2.1 *The Resource Management Act***

The Resource Management Act 1991 (RMA) was hailed upon its enactment as one of the most advanced pieces of resource management legislation in the world. It replaced more than twenty major statutes and fifty other laws relating to the environment. These previous laws and administering agencies had developed in an uncoordinated manner, resulting in an *ad hoc* approach to environmental management, creating considerable conflicts, gaps and overlaps (Ministry for the Environment, 1999). The RMA set out to create a new streamlined, integrated and comprehensive approach incorporating the concepts of sustainable management (Ministry for the Environment, 1999), while building on previous planning experience and mechanisms. However, one drawback of this is that many facets of the RMA lack established case law to guide policy interpretation by local authorities.

Resource management under the authority of the RMA is carried out through an interlocking hierarchy of plans and policy documents. These occur at national, regional and district levels, with the requirement that each level is not inconsistent with those above it (i.e. district plans must not be inconsistent with national or regional documents, and regional plans and policy statements must not be inconsistent with national plans and policy statements).

The natural hazard provisions in the RMA are intended to allow individuals and councils to balance the benefits and costs of permitting activities in flood-prone areas (Blakely, 1994), and encourage people to avoid situations where they or their property is placed at unacceptable risk (Phizacklea, 2001).

### **3.2.2 Definition of Natural Hazards**

Section 2 of the RMA defines a natural hazard as;

*“any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire or flooding, the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment”*

This incorporates the main points of literature definitions discussed earlier, and also includes adverse effects on environmental aspects, reflecting the holistic intentions of the RMA. However, the Section 2 definition is inconsistent with that given in Section 106 of the RMA, which restricts the ability of territorial authorities to grant subdivisions in certain circumstances relating to certain specified hazards. The definition in Section 106 appears to be taken directly from the subdivision restrictions of the Local Government Act 1974, apparently the result of ‘sloppy drafting’ (Edmonds & al, 1994). The result of this is the inability of a consent authority to refuse a subdivision consent for a property that is subject to a natural hazard not listed in Section 106 (*ibid*).

In the *Application by Canterbury Regional Council* (1995), the Planning Tribunal concluded that a natural hazard and its effects are two separate and identifiable entities (Cowper, 1995). This view is inconsistent with the theoretical framework of natural hazard

management, which defines a natural hazard by its effects or potential effects. This approach has the potential to cause difficulties when integrating the management of natural hazards between district and regional levels.

### ***3.2.3 Division of Responsibilities***

Natural hazard management responsibilities lie with government, and are different at each level. Although the major responsibility lies with local government, central government is intended to have a role, even though this is not stated explicitly in legislation (Bewick, 1990). While the enactment of the RMA has devolved much decision-making power to local government, the New Zealand government retains a fundamental responsibility to protect the security, safety and welfare of its citizens and communities (MEM, 2000). This is accomplished through the following:

- Developing legislation enabling effective natural hazard management practices through the Ministry for the Environment (e.g. RMA Amendments);
- Provision of centrally co-ordinated emergency management services such as the Ministry of Emergency Management;
- Financial relief programs, provided after disasters.

At local government level, natural hazard management is designed to be a shared and co-ordinated activity between regional and district councils, each with complementary and overlapping responsibilities. The RMA contains explicit descriptions of the functions of regional and district councils. The functions of regional councils are stated in section 30(1) of the RMA. The subsection relevant to natural hazards is;

- (c) *The control of the use of land for the purpose of –*
  - (iv) *The avoidance or mitigation of natural hazards*

Different regulations exist in respect to the coastal marine area. Catchment and regional water board functions were absorbed into regional councils with local government reforms (CSC, 2000).

Territorial authority functions are stated in Section 31, and include;

- (b) *The control of any actual or potential effects of the use, development, or protection of land, including for the purpose of the avoidance or mitigation of natural hazards.*

This difference in wording (“control of the use of land” in Section 30, compared to ‘control of any ... effects of the ... use of land’ in Section 31) has created some confusion over the appropriate division of responsibility between local government levels. While some initially considered that this difference was not significant and that both levels of local government were responsible for natural hazard management (Edmonds & al, 1994, Blakely, 1994), several actions were undertaken to clarify the situation. The 1993 Amendment to the RMA addressed this issue through regional policy statements in Section 62;

- (ba) *For the region or any part of the region, which local authority shall have responsibility within its own area for developing objectives, policies, and rules relating to the control of the use of land for –*
  - (i) *The avoidance or mitigation of natural hazards – and may state particular responsibilities for particular hazards...; but if no responsibilities are identified in the policy statement, the regional council shall retain primary responsibility for the hazard.*

This identifies the regional council as the ‘default option’ for natural hazard management responsibility, unless the Regional Policy Statement (RPS) specifically states that a local authority shall have responsibility. While this has been described as the key to the resolution of the problem of overlapping responsibilities (Edmonds & al, 1994), in the case of disputes or inconsistencies in plans, while Section 75(2) provides a technical response, this may not result in the development of workable solutions (Cowper, 1995). The respective councils still must come to a practicable agreement on how to deal with natural hazards.

The issue of respective roles was also addressed in *Application by Canterbury Regional Council* (1995). In this case the Banks Peninsula District Council argued that a regional council

cannot include rules in a regional plan which restrict activities for the purpose of mitigating the effects of natural hazards. A regional council could only control land use for the purpose of controlling or mitigating occurrences which constitute a hazard, and not for preventing loss or damage (Cowper, 1995). The Canterbury Regional Council argued that the effect of a natural hazard is not separable from its occurrence and must be managed as such. The decision of the Planning Tribunal was that the omission to refer to the effects of natural hazards in relation to regional councils was a deliberate distinction intended by Parliament (Cowper, 1995).

The decision was appealed, and although natural hazards were not specifically considered by the Court of Appeal, other subsections of Section 30(1)(c) were, and the logic and conclusions reached can be applied to Section 30(1)(c)(iv) (Cowper, 1995). The Court stated that despite the wording of Section 31(b), it is difficult to see how a territorial authority could control the effects of use without regulating the use itself (i.e. separating the control of the effects of land from the control of land use is not always possible) (Cowper, 1995).

Regional Councils	District Councils
<ul style="list-style-type: none"> <li>• Hazards of regional level significance</li> <li>• Research into natural hazards, and dissemination of information</li> </ul>	<ul style="list-style-type: none"> <li>• Hazards of district level significance</li> <li>• Implementation of detailed hazard avoidance and mitigation through land management</li> </ul>
<ul style="list-style-type: none"> <li>• Regional policy development</li> <li>• Works and services at regional level</li> <li>• Regional civil defence and monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Hazard management plans</li> <li>• Works and services at district level</li> <li>• Control of regulatory methods such as Building Codes</li> </ul>
<ul style="list-style-type: none"> <li>• Regional advocacy and education</li> </ul>	<ul style="list-style-type: none"> <li>• Provision of information on site specific and localised natural hazards</li> </ul>
<ul style="list-style-type: none"> <li>• Preparation of regional plans</li> <li>• Maintaining a regional hazards register</li> </ul>	<ul style="list-style-type: none"> <li>• Maintaining a district hazards register</li> </ul>

**Table 1:** *Division of natural hazard responsibilities between regional and district authorities*

(Sources: Chapman, 1995, Hinton & Hutchings, 1994)

While this was occurring, however, the majority of natural hazard responsibility divisions were well understood, and adopted by regional and district councils seeking practical interpretation of the legislation. A summary of these is shown in Table 1. Section 62(ha) of the RMA appears to have allowed the creation of a workable agreement between regional and district councils.

### *3.2.4 Legislative Tools*

Effective mechanisms for preventing development in flood-prone areas are provided by the Resource Management Act, and the Building Act 1991. The relevant sections of these Acts allow consent authorities to control or restrict subdivision and building where a hazard is perceived.

Section 106 of the RMA restricts the granting of subdivision consents where the land is, or is likely to be, subject to certain natural hazards. Subsection 2 states that before a subdivision is granted, the consent authority must be satisfied that the natural hazards listed in subsection 1 will be 'avoided, remedied or mitigated' by rules in the district plan, resource consent conditions, or works. However, no guidance is given by the RMA over the degree of mitigation required. It is considered that the Environment Court would demand a high level of mitigation, and that a council would be prudent to adopt avoidance as the standard (Edmonds & al, 1994).

The Building Act is considered to be more prescriptive and regulatory than the RMA (Chapman, 1995). While the RMA can be used to protect society from natural hazards with flexible implementation at local level, the Building Act enables people to accept the risk posed by hazards (Chapman, 1995). Section 36(1) of the Building Act instructs a territorial authority to refuse to grant a building consent if the land in question is subject to, or is likely to accelerate, worsen, or result in a specified natural hazard, unless it is satisfied that adequate provision has or will be made to protect both that land or other properties from the hazard. Subsection (2) allows a building consent to be granted where the land is subject to, or likely to be subject to, these hazards, provided that the District Land Registrar is notified, and a special entry made on the certificate of title. The New Zealand Building Code, clause E1.3.2, specifically requires measures to be taken to protect buildings from the 2% AEP flood. Building standards shall not be required to

achieve more restrictive criteria than that stated in the Building Code, except for the protection of adjoining properties from surface flooding (Sections 7(2), 68(2A) and 76(2A)) (Sheldon, 1994).

Natural Hazards can also be controlled through regional or district plans, and conditions on consents. Methods available for this include;

- The provision of information on hazards, kept as a requirement of section 35(j) of the RMA. Most authorities keep “Natural Hazard Registers” to meet this requirement.
- Education of the public about the risk of natural hazards, and actions that may be taken to minimise vulnerability. This may encourage changes in behaviour, particularly in developed areas (Edmonds & al, 1994).
- Regulation, including zoning of hazard-prone land, requirement of information with resource consent applications, and allowing flood protection works to be permitted activities.
- The establishment or enhancement of structural event modification works. However, these actions are subject to the matters of Section 32 of the RMA to ensure that they are necessary, effective and efficient (Edmonds & al, 1994).
- Section 220 of the RMA sets out conditions that may be imposed on subdivision consents. These can include requiring esplanade strips or reserves to be set aside to mitigate natural hazards, requirements such as location or minimum floor levels of any buildings, the establishment of structural works, or a condition that provision be made for the protection of all or part of the land, or other land, against certain hazards, including inundation, to the satisfaction of the council (Edmonds & al, 1994).

The RMA and BA provide local government with the power to manage natural hazards by placing controls on subdivision and building on flood-prone land. However, where existing developments are threatened by newly created flood hazards, the methods available to councils to manage this are restricted to providing information and education, and the establishment of structural protection works.

### 3.2.5 *Liability*

The RMA does not exempt territorial authorities from civil liability for granting a subdivision consent under Section 106 (Edmonds & al, 1994). Concern was expressed during the assessment of the Resource Management Bill that the greater responsibility of local authorities to provide information on hazards would make them vulnerable to claims of negligence (Bewick, 1990). Consideration was given to protecting local authorities and their staff from such liability, but the Crown enacted no such provisions, deciding that where local government acts in a technically competent and professional manner, such protection is unnecessary (*ibid*).

The Building Act exempts territorial authorities from civil liability associated with the issue of a building consent with knowledge that the building may be at risk from a natural hazard, provided the procedures of Section 36 have been followed correctly and that damage arises from the natural hazard referred to on the certificate of title (Edmonds & al, 1994).

Each of these methods require that the consent authority be 'satisfied' of certain matters. To insure reasonable grounds of satisfaction, a council must make the necessary inquiries and use all information that it has available concerning the associated risks (Edmonds & al, 1994).

Despite the prescriptions of the RMA, there are several outstanding issues associated with natural hazard management by local authorities. In the ten years that the legislation has existed, much of this is untested by case law. These issues are listed below:

- Is the common law duty of care negated with warning applicants of the risk?
- Does council have to go further than warning, and share any information it has concerning the risk?
- Should public money be spent protecting private assets?
- Is the risk something that private property owners face in exchange for their location?



- Should the Crown or local authorities provide compensation for damage to interests in land resulting from the provision of, or failure to provide, structural works?

(From Rice, 2001, p102)

The question of liability is of importance to local authorities, whose actions must be both defensible, and shown to be necessary (Section 32, RMA). With an increasingly legalistic approach to land management in New Zealand, these issues may create uncertainty amongst regulatory bodies, hindering their effectiveness in managing natural hazards.

### 3.2.6 *Existing use rights*

While the mechanisms given to local authorities are considered effective in preventing new development in flood-prone areas, there has been no provision made for dealing with existing developments that have become at risk due to changing flood characteristics, either natural or anthropogenic. Ericksen (1986) stated that although it would be in the national interest to relocate flood-prone development, the real problem is that no formal mechanism exists within existing flood-loss policy to provide the economic incentives for such relocation. It appears that fifteen years and a complete legislative change have not addressed this issue.

Rather, a different perspective has been adopted, whereby structures and activities established prior to the RMA are specifically exempt from having to comply with this legislation under the provisions of Section 10.

- (1) *Land may be used in a manner that contravenes a rule in a district plan or proposed district plan if –*
  - (a) *Either –*
    - (i) *The use was lawfully established before the rule became operative or the proposed plan was notified; and*
    - (ii) *The effects of the use are the same or similar in character, intensity, and scale to those which existed*

*before the rule became operative or the proposed plan was notified.*

This protection is dependant on the structure or activity having been lawfully established prior to the rule it contravenes, and “the effects of use” being “the same or similar in character, intensity and scale”.

The implications of this for natural hazard management are demonstrated in *McKinlay v Timaru District Council*, 2001. This case concerned how existing use rights under Section 10 of the RMA apply to the reconstruction of a building which is destroyed by a natural hazard, such as a flood, where such reconstruction is otherwise prohibited by a rule in the proposed District Plan. The importance of Section 10(4)(a) on this case was noted;

(4) *For the avoidance of doubt, this section does not apply to any use of land that is;*

(a) *Controlled under section 30(1)(c) (regional control of certain land uses)*

In this case, the Regional Policy Statement contained objectives, policies and methods (but not rules) as to how natural hazards should be managed. The District Council argued that rules in a regional plan were not necessary to control the use of land in relation to natural hazards, as Section 75(2)(c) of the RMA requires that “a district plan must not be inconsistent with the regional policy statement”, and regional council control came through district plan rules not being inconsistent with the objectives, policies and methods of the Regional Policy Statement.

However, the Environment Court decided that this did not amount to actual control by the regional council, as Section 68 of the RMA recognises that control of a land use requires such rules in a regional plan, and that there was a difference between having a right to control, and exercising that right. The decision stated that,

*“despite the provisions of the proposed district plan, the existing use rights under section 10 of the RMA do extend to allow reconstruction of the household units ...in the event of destruction*

*of any existing houses by ... natural hazards provided that the dwelling to be rebuilt is the same or similar in character, intensity, and scale as that which presently stands”*

It was mentioned that the situation might be different if there was a relevant proposed regional plan, and Section 20(2)(c) applied. In this case, an application for a resource consent for the continuation of the activity would be required within six months of rebuilding. However, this method of restricting redevelopment has not been tested before the Environment Court, and the extent and duration of the existing use rights would need to be determined (*McKinlay vs. Timaru District Council*, 2001).

This decision demonstrates that if the risk of a natural hazard to existing development is perceived, while a district council can prevent new development by implementing changes to the district plan, existing development is protected by Section 10. Even if the buildings are damaged or destroyed by the natural hazard identified by the rule, a council cannot prevent their repair or reconstruction. It can be seen that the issues raised earlier in this Chapter are applicable in this situation. With no established case law or legislative tools to deal with this situation, councils must attempt to manage these situations pragmatically, within their resources. This has the potential to lead to uncoordinated responses, and of councils effectively ‘reinventing the wheel’.

### 3.3 Conclusion

The RMA and Building Act provide local government with a range of legislative and statutory tools for firstly, reducing exposure to natural hazards, and secondly, allowing acceptance of a certain degree of risk.

Flood management in New Zealand has been a concern since first European settlement, and there is a long history of institutional and legislative response. From an early ‘engineering focussed’ approach, based on the maximum use of flood prone land, a change occurred towards land use and planning controls to lessen the flood risk potential. However, despite the opportunity for change, these non-structural approaches were applied hesitantly, resulting in a continuing high flood risk in many New Zealand urban areas.

The post-1991 natural hazards regime (Resource Management Act and Building Act) has replaced this with a process whereby new developments must 'satisfy' the consent granting authority that the vulnerability to flooding has been reduced below a specified level. However, in the case of existing development, council methods are limited to the provision of information and the establishment of structural protection works. They lack the process to even prevent a building that has been destroyed by a recognised natural hazard being rebuilt, due to the interpretation of Section 10 of the RMA.

Chapter Four presents the methodology for the research project. This describes and justifies both the primary and secondary data collection techniques, and the method of analysis of the results.

## Methodology

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The purpose of this study is to determine the response of a local authority, within the constraints of statutory and legislative boundaries, to an increased flood hazard that threatens an established urban area. From an understanding of the dynamics of this response, and reasons for actions taken, mechanisms will be identified that other local authorities can adopt in response to situations of this type. This study involves an in-depth examination of statutory bodies managing a situation not provided for in legislation, and an examination of the reasons for responses that have occurred.

The research also involves a significant empirical component; it includes factual observations of a real world context - Alexandra, where three serious flood events in 1994, 1995 and 1999 have prompted responses at community, local government and central government levels. The study seeks to understand and explain these responses through analysis. A qualitative methodology focussing on interpretation and understanding is employed to explore the relationships between the organisations involved and the increased flood hazard.

### 4.1 Research Methods

This study generates data from both primary and secondary sources. The use of multiple methods allows corroboration and augmentation of data through the process of triangulation, whereby separate investigative methods converge on the object of study, allowing a higher degree of validity and reliability to be achieved, and a variety of information to be obtained (Sarantakos, 1993).

#### ***4.1.1 Secondary Source Material***

Secondary data sources are employed to review flood management and natural hazards research theory, and the New Zealand historical natural hazard management legislation to determine:

- The current concepts and paradigms relating to natural hazards theory;
- If procedures to resolve conflict between established urban areas and increasing natural hazards have been determined, and;
- The statutory and legislative context within which local bodies in New Zealand are constrained.

This approach is taken to avoid the duplication of previous work, and provide a foundation on which to base this study. This information also provides a context from which empirical research can be conducted more effectively by identifying gaps in existing knowledge (Stewart & Kamins, 1993).

Secondary data sources consulted include the following:

##### *Documentation*

This data source has the advantage of stability, broad coverage of the topic, and of including a body of professional literature existing independently of the study (Yin, 1994).

The literature consulted in this study can be categorised into several primary topic areas;

- That relating to natural hazard theory research. This has developed from the late 1940s onwards, and combines the fields of science, engineering, economics, planning and social sciences,
- Literature specifically related flood management and control, which draws on the fields of planning and engineering, and
- New Zealand specific literature on natural hazard management legislation and context.

### *Archival Records*

Records of past flood events provide details and factual accounts of the occurrence and effects of flooding in the study area to establish causal links with the actions of interested parties. The main sources of these records are ORC reports and newspaper stories.

#### **4.1.2 Primary Source Material**

The empirical research for this project consists of a case study of the response of institutional bodies to an increased flood hazard in Alexandra. A case study was chosen as it offers a distinct advantage where empirical information about responses connected with a contemporary phenomenon is required to answer 'how' and 'why' questions (Yin, 1994). It can also be used to gain insights with wider implications than the particular case studied (Denscombe, 1998).

*"the essence of a case study ... is that it tries to illuminate a decision, or set of decisions: why they were taken, how they were implemented, and with what results"*

(Schramm, 1971, in Yin, 1994.)

Although the case study approach has been criticised for possessing a lack of objectivity and rigor, it is recognised as an essential form of social science inquiry (Yin, 1993), appropriate when the investigation is to:

- (a) define topics broadly;
- (b) study both the phenomenon of interest and the contextual conditions as one unit, and not just aspects of this;
- (c) perceive the respondents as experts, not merely as sources of data, and;
- (d) study a typical case.

(From Yin, 1993, Sarantakos, 1993)

Information collected from archival and documentation sources is supported and expanded on through key informant interviews. Interviewees were selected from the statutory groups (Otago Regional Council (ORC), Central Otago District Council (CODC), and the Alexandra Community Board (ACB)) that were involved in the

response to flooding in Alexandra through their statutory obligations, based on their personal involvement in, and experience of the issue. It became clear early in the investigation that several key people were 'at the heart of the matter' (D. Whitney, 2001, *pers. comm.*), being involved in both the formulation of the Central Otago District Council response, and in negotiations with Central Government as representatives of the Alexandra Community Board. Other interviewees were involved in the planning and natural hazards management framework, including the formulation of the Central Otago District Plan, and at the District Council and Regional Council levels. A list of those interviewed is presented in Appendix 1. In some cases, several people from the same organisation were interviewed in order to give a robust, three-dimensional insight into the response to the increased flood hazard in Alexandra, as well as any perceived limitations imposed by relevant legislation or duties of local government.

The interviews were semi-structured. This involved a clear list of issues to be discussed, and possible questions (Appendix 2), but also allowed flexibility to discuss other issues and develop points of interest more fully (Denscombe, 1998). Respondents were interviewed solely in their professional capacity, about understandings of relationships and context, and reasons for actions or lack of action taken. The interviews were conducted at a place specified by the respondent, usually council offices. A reciprocal approach was adopted for the interviews, with both parties demonstrating knowledge on the topic and sharing interpretations and ideas. This minimised repetition of facts while encouraging the interviewee to add to the research knowledge by expanding on ideas and presenting interpretations of events.

## 4.2 Data Analysis

Key interview notes were analysed for information concerning the research objectives. This information was sorted under suitable topic headings, assembling multi-faceted views of the major issues concerning the response to flooding. Different interviewees addressing the same topics of importance allowed a more complete understanding of the information to emerge than would otherwise have been the case. This also allowed the background reasons for actions taken to be determined.



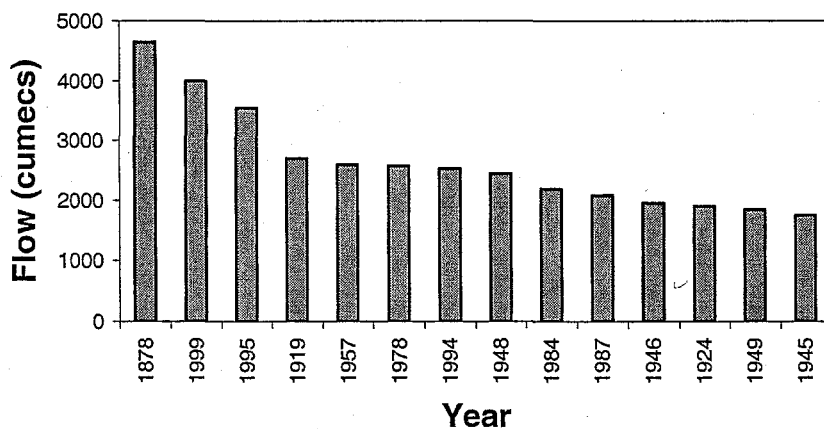
These topics were then compared with the theoretical foundations of flood hazard management determined in Chapters Two and Three, and their relationship with these allowed the determination of conclusions addressing the research objectives to be developed.

The next Chapter consists of a description of the Alexandra township context, including the causes of the increased flood hazard, the timing and effects of the flooding, and the local government response to this.

## The Alexandra Case Study

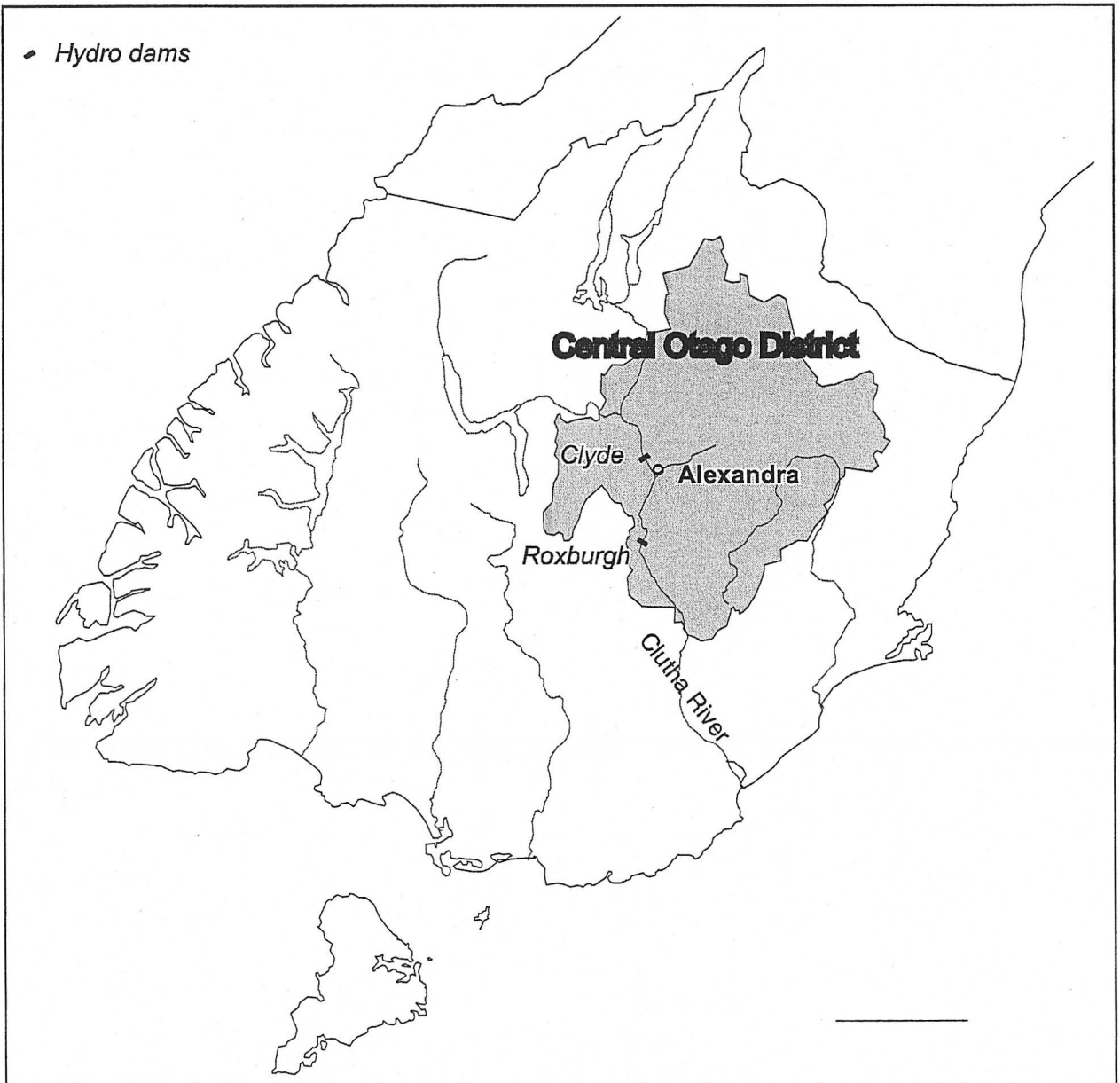
### 5.1 Historical Flooding

Situated on the banks of the Clutha River, the largest in New Zealand, Alexandra has been subject to severe flooding in the past. In 1878, the largest ever recorded flow flooded the infant town and causing considerable damage. This flood had an estimated peak flow of 4600 cumecs, compared with a normal flow of under 400 cumecs. All estimated peak flow estimates at Alexandra over 1750 cumecs are shown on Figure 4.



**Figure 4;** Peak River Flows for Recorded Floods at Alexandra (*data from ORC, 2000*)

The occurrence of three major flood events between 1994 and 1999 demonstrated beyond doubt the presence of an increased flood hazard, and prompted action by local government. Accordingly, it is seen as being an ideal case through which to study local government response to an increased flood hazard.



**Figure 5;** Location map

On 10<sup>th</sup> January 1994, torrential rain caused widespread flooding throughout Otago, Fiordland and Southland (ODT, 10/1/94, Rain lashes Otago & Fiordland). Flooding, combined with slips and lightning strikes (King, 1994) resulted in a declaration of a state of emergency in Alexandra due to the flooding of the water pumps at the town's borefield (ODT, 11-1-94, Emergency in Alexandra). Three thousand people, mainly on holiday, were evacuated, and four houses and the Alexandra Jaycees clubrooms were flooded (Duggan, 1994a, Worrall, 1994a). The Clutha River peaked at 140.03m above sea

level at the Alexandra Bridge with a maximum of 2373 cumecs passing through the Clyde Dam (Galer, 1994, Opus, 2000).

Alexandra was flooded again on the 13<sup>th</sup> December 1995, with a record 67.7mm of rain falling in 24 hours (Stevens, 1995). This was described as 'the worst flood in the 131 year history of the town' with the Alexandra Museum, the Bendigo Hotel, several businesses and shops and over a dozen houses being flooded (Fridd, 1995b). The Clutha River peaked at 3550 cumecs, and the plaque marking the peak of the 1878 flood was submerged as the Clutha rose to RL 141.9m at the Alexandra Bridge (Duggan, 1995a). Some places 'flood-proofed' after the 1994 floods, or above the flood risk area, were flooded (Fridd, *ibid*).

A 72 hour rainstorm over Otago and Fiordland created a major flood on the 17<sup>th</sup>-18<sup>th</sup> November 1999, in Central Otago and Southland (Opus, 2000). A civil emergency was declared on the 17<sup>th</sup> in Alexandra, with the Bendigo Hotel and twenty-nine businesses in lower Tarbert Street, Limerick Street and Althone Street flooded (King, 1999). Several hundred residents were evacuated, water supplies were cut, and many roads were closed. Queenstown and Wanaka were also flooded, with the highest recorded level on Lake Wakatipu since 1878, and Lake Wanaka exceeding the 1878 level by 2cm. At Alexandra, a peak flow of 3800 cumecs created a peak flood level of RL 142.3m, higher than both the 1995 and 1878 floods (Opus, 2000).

## **5.2 The Increased Flood Hazard**

### **5.2.1 Roxburgh Dam**

The Roxburgh Dam was commissioned in 1956, in order to meet the power needs of a rapidly developing post World War Two economy. Although it was well known at the time that the Clutha was subject to extreme flows on a regular basis, and carried a high sediment load, construction of the dam was carried out, most probably due to the extreme confidence in the power of engineering projects to harness nature in this era. The original intent to manage any increased flooding from this was to purchase land prone to flooding due to the dam. Near Alexandra, this was considered to be the RL

140.3m, thought to have been equivalent to the 1878 flood level (various reports and memoranda, Ministry of Works and other Crown agencies, *in* CSC, 2000). This was soon found to be too low a level, primarily due to the accumulation of sediment in the upper reaches of Lake Roxburgh. Further investigations established a new level of RL 141.5m at the Manuherikia River Confluence, and in early 1981 approval was granted for government purchase of land on this basis. However, this was not carried out for all affected land (CSC, 2000).

### 5.2.2 *Sedimentation as a cause of flooding*

The Clutha is New Zealand's largest catchment, and drains a tectonically active, rapidly eroding mountain range. The Shotover is the main sediment source for the Clutha (CSC, 2000). It carries a huge sediment load that formerly drained to the East Coast, replenishing beach sands. However, the construction of dams has interrupted this natural process, and trapped the sediment behind the dam.

The slowing of river water as it first encounters the low velocity flows associated with a lake causes sediment to settle out at the upstream end of the lake. This has caused the river bed downstream of the Manuherikia River confluence to rise, resulting in 'a propensity to flood surrounding land at lower flows than would otherwise be the case' (CSC, 2000, p32). This has also caused higher flood levels within Lake Roxburgh, with resultant backing up of the river flow (*ibid*). It is estimated that 45 million m<sup>3</sup> of sediment had been deposited behind the Roxburgh Dam before the commissioning of the Clyde Dam (Johnstone, 2000).

This is demonstrated by historical flood data; the 1999 flood peaked at RL 142.25m with a flow of 3800 cumecs, while the 1878 flood, with a flow of 4650 cumecs, produced flooding to the lower level of RL 140.5m (Johnstone, 2000). It is estimated that the 1999 flood peak was approximately 3.2m higher than would have occurred had the Roxburgh Dam not been constructed (*ibid*).

Construction of the Clyde Dam in 1992 has prevented sediment sourced from the Shotover and other upstream catchments from reaching Lake Roxburgh since this time. Instead, this sediment is trapped in Lake Dunstan, especially in the Kawarau Arm

(Johnstone, 2000). It is significant that two of the worst floods to strike Alexandra have occurred after sediment accumulation behind Lake Roxburgh ceased. Indeed, sediment within Lake Roxburgh has been redistributed due to the scouring action of the 1994, 1995 and 1999 floods, progressively reducing flood profiles at Alexandra (*ibid*). This is estimated to have reduced flood levels 1.5m since the commissioning of the Clyde Dam (*ibid*).

### 5.3 Institutional Structure

#### 5.3.1 Otago Regional Council

Alexandra is situated within the boundaries of the ORC, which contains the entire catchment of the Clutha River. The Regional Policy Statement is the main document by which the ORC manages the flood hazard.

#### Regional Policy Statement (1998)

Chapter 11 of the RPS deals with natural hazards. It mentions flooding as a serious threat to Otago people and communities, and states that it is essential to “avoid or mitigate the threat through appropriate means including defences against water which need on-going maintenance”. The role of human activities in forming a hazard is mentioned, as is the individual choice of people to balance locational risks and benefits. Responses to the likelihood of a natural hazard occurring can take one of three forms (RPS, 11.1):

1. Avoiding the hazard, through measures such as relocating development away from areas under threat of flooding or preventing development in these areas.
2. Mitigating the impact of the hazard by reducing its effects. The example given for this is the construction of stopbanks to control floodwaters.
3. Enduring the event and undertaking cleaning up and rebuilding afterwards. This involves civil defence services, and private insurance policies.

Natural hazard responsibilities are stated, as is required by Section 62(ha) of the RMA:

### **Otago Regional Council;**

- Investigation and provision of information to all agencies on regionally significant hazards.
- Development of objectives and policies for regionally significant mitigation works, and land that is affected by inundation.
- Development of objectives, policies, rules and other methods with respect to activities that may exacerbate inundation.
- Enabling community responses to flood hazard where necessary, subject to the requirements of the RMA, such as maintaining or constructing river control schemes.

### **Territorial Local Authorities;**

- Preparation of information on site specific and localised hazards that may affect any component of the built environment under the Building Act
- Development of objectives, policies and rules where land is affected by a natural hazard, or where development may exacerbate a natural hazard.

The specific responsibilities concerning the exacerbation of natural hazards are left undefined, and are to be determined in response to each specific hazard situation, in order to ensure effective and efficient management. Factors influencing the division of responsibilities may include the capacity of the authority, acceptability of responsibility, the scale of effects, and efficiency and cost minimisation factors.

Specific issues stated in the RPS of concern to an increasing flood hazard are as follows:

Issue 11.3.4 states that there are risks to existing developments that can only be dealt with through mitigation measures, such as establishing or maintaining structures or vegetation to afford protection, taking out insurance to offset losses, or avoiding the hazard by physically moving the structure or activity out of the hazard zone.

Issue 11.3.6 recognises that human activities (here termed ‘inappropriate’) can increase the intensity and frequency of natural hazards.

Policies addressing these issues are also stated, and are; taking action necessary to avoid or mitigate the unacceptable adverse effect of natural hazards and the responses to natural hazards on human life and infrastructure and property, restricting developments on sites recognised as prone to significant hazards, and establishing the level of natural hazard risk that threatened communities are willing to accept. These are to be accomplished through a wide range of methods, including constructing river and flood control schemes, but focuses on community consultation and education techniques.

### ***5.3.2 Central Otago District Council***

The Central Otago District Council administers land use and development control through its District Plan.

#### **Proposed District Plan (1998)**

The Central Otago District Plan groups natural hazards with technological and human induced hazards within Section 17: Hazards.

Flood hazard management is categorised in three ways:

- 1) structural responses, such as stopbanks;
- 2) non-structural methods, reducing the frequency and intensity of occurrence by the use of appropriate land management practices or exclusion or control of development in hazard-prone areas;
- 3) loss modification through flood warning systems, civil defence responses and insurance cover;

although the District Plan is largely concerned with the non-structural approach to hazard management.



Flooding is recognised as a hazard (Issue 17.2.1), and both the potential costs of allowing development in hazard-prone areas, and the potential lack of awareness of hazards are mentioned as issues. The choice of people to accept both the benefits and risks of hazard-prone sites is accommodated to some degree through the building and resource consent process.

Planning maps show the highest flood levels recorded for the township, and place development restrictions on areas below these lines. These have been updated after each floods since 1994.

### ***5.3.3 Alexandra Community Board***

The CODC has one of the most devolved structures in New Zealand, with community boards operating under the delegated authority of the Council. The community boards consist of local elected representatives which resolve local issues and make budgetary decisions. As such, the Alexandra Community Board had a large role in responding to the flood hazard experienced by the Alexandra community.

Several members of this board are also involved with the Central Otago District Council, including District Councillors and the Deputy Mayor, and undertook several roles during the flood hazard response.

## **5.4 Response to Flooding**

### ***5.4.1 The 1994 Flood***

This led to the commissioning of a joint study by the Electricity Corporation of New Zealand (ECNZ) and the Otago Regional Council to assess the causes of flooding in Alexandra, covering dam operations and the build up of silt at the head of Lake Roxburgh (Duggan, 1994b). This study recommended the scouring of the sediment build-up by flushing the lake as the most effective long-term flood reduction solution. It concluded that the estimated \$1.4 million cost of flood protection works would exceed the flood damage that it would prevent (Worrall, 1994b). However, the water-supply

chlorination unit and the switchboard controlling the main sewerage pumps were raised 1.5m following the flood (Fridd, 1995a). ECNZ made some ex-gratia payments to flood victims, but denied any liability for the flooding.

#### **5.4.2 The 1995 Flood**

Following this disaster, the ACB called for an independent inquiry into the cause of the flooding (Duggan, 1995b), and CODC councillors moved that Contact Energy, the company that took over operation of the Clutha dams following privatisation of ECNZ, be sent a bill for uninsured flood damage to roads and services (Fridd, 1996a). Contact Energy stated that they were not liable for any flood damage caused by dams on the Clutha River, but were prepared to negotiate compensation payments with affected individuals (Fridd, 1996b).

Difficult negotiations over compensation and liability between Contact Energy and flood victims continued for several years, but by mid-1997 most claimants had managed to reach settlement individually (O'Connor, 1997a). The CODC also settled a long-running flood compensation dispute with Contact Energy (Smith, 1999), but the Crown refused to accept either legal liability or a moral obligation to purchase Council land lying under the 141.5m contour, as it had for private properties in the early 1980s (Duggan, 1999).

#### **5.4.3 The 1999 Flood**

This was the largest of the three floods, and exceeded the peak level of the previous highest flood of 1878. Response to this flooding was united and prompt, in comparison to the earlier events of the 1990s. As one interviewee stated, “*After the bad experience with settlements after the 1995 flood, we made a decision not to repeat that*”.

Once the immediate flood damage had been dealt with, a public meeting was called by the ACB in order to coordinate a community response to the flooding issue. At this meeting, the creation of a Clutha Solutions Coordinator position (CSC) was the main issue, with a suitable candidate lined up by the ACB. However, no funding was available at this time. Following consultation with both the old and new governments (the

flooding occurred ten days before the 1999 general election, when Labour replaced National as the Government), the Prime Minister appointed Alex Adams to this position. The CSC was to work closely with the Prime Minister's Department, and was provided with resources and payment by the Ministry for Civil Defence and Emergency Management. The brief for this position was to investigate practicable long term solutions to the flooding with an emphasis on urban areas. Of six key tasks, the fifth was:

*Examining the specific issue of siltation of the hydro lakes and the repeated flooding at Alexandra.*

At this stage, the CODC, on behalf of the ACB, instigated the community driven Future Directions Study to investigate possible solutions to protect flood affected properties from future inundation. A need was perceived for a report focussing specifically on the Alexandra situation, with a maximum of community consultation, in order to develop a robust case for compensation. The risk management consultancy, Optimix, was employed for this task.

### **Clutha Solutions Coordinator (CSC)**

As already noted, this short-term position was created to investigate practical solutions to the flood hazard along the Clutha River. All parties interviewed in this study regarded this as an extremely effective mechanism for dealing with the situation. Aside from the stated objectives, the Coordinator defined the role of this position as having several elements. These included; sorting through the available information in a logical and unbiased manner to balance misinformation in the community and provide a factual basis to discussions; causing the parties responsible for the increased flood hazard to front up to their responsibilities, without getting bogged down in either historical confrontational positions, or strict legal liability; acting as a facilitator to get the different parties focusing on the same issues; and producing a succinct set of recommendations that would allow resolution of the issues.

The main strengths of the position were perceived to be its impartiality, and the short-term nature of the assignment. As the appointment was agreed on by the three District Councils containing the Clutha River, the Otago Regional Council, and both main

political parties, and while reporting to all of these, separation from any one party was effectively maintained. The fact that the position did not involve politics at any level allowed tough decisions to be made. The limited duration of the assignment created a need to make major decisions based on present facts in order to finish the project with an outcome. This limited nature did not permit all final details to be worked out, but it did prevent hesitancy in decision making. Other benefits included public accessibility to the Coordinator, and the ability to present factual information that was accepted by the community.

### **Future Directions Study (Optimix, 2000)**

This parallel study was developed by the CODC and the ACB, in consultation with the CSC and the ORC, to resolve issues on the future of Alexandra as a result of frequent flooding (Optimix, 2000). The stated goal was to protect the community from flooding, and to provide a basis for a vibrant community. This was seen as a 'community owned' study, and consultation was a vital component, required throughout the report. In all, 144 formal submissions were made, and an extensive consultation programme, involving meetings with the public, sector groups, and affected parties, throughout the report. The contract ran from 3<sup>rd</sup> April to 30<sup>th</sup> June 2000.

The scoping report considered four main options:

- construction of flood defences with associated property purchase;
- relocation of the town;
- silt movement from Lake Roxburgh, and;
- an indemnity fund that would insure against all risks of future flooding.

Of these, only the construction of flood defences was fully considered, with the possibility of future investigation into silt movement. A broad-brush economic evaluation was conducted, showing that the indemnity fund gave the most effective rate of return of all the options. However, this was not considered a workable option by residents who wanted to reduce the flood risk in their community, and not live with the flood risk. Neither the relocation of the town, or silt removal, gave positive benefit ratios, and relocation received very little community support, while concentrating on silt

movement was not seen as an efficient use of resources. While building flood defences was favoured from an early stage, the report also recognised the new risk that would be created should flood defences be overtopped. From this basis, detailed costs for flood defences were developed in later reports.

The CSC report, and the Future Directions Strategy were described as a 'two barrel approach', providing a case for compensation to the Crown, along with a detailed description of how this compensation would be used to alleviate the flood hazard.

On this basis of these reports, a compensation and redevelopment package of \$21.58 million was made by the Crown to the community of Alexandra for compensation, property purchase, protection works, and general matters associated with the flooding. Following the recommendations of both the CSC and the Optimix report, structural flood defences and purchase of flood prone land were decided on. Construction for this began in 2000 with an expected completion date of 2003.

The proposed stopbanks vary in height between 400mm and 4 m above existing ground levels. The design flood level is 142.75 m above sea level, and the top level of the flood protection will be 500 mm higher than the design flood level, at 143.25. This will allow free board to accommodate wave action and settlement.

Flood-prone properties that were underneath the 'footprint' of the planned flood defences, and those that would not be protected by these structures were purchased with compensation money. In a change from the Optimix recommendations, those properties that were flooded, but judged to be protected by the installation of defences, were not purchased.

## 5.5 Conclusion

The Alexandra community, while historically at risk from flooding of the Clutha River, suffered three major floods between 1994 and 1999, each of increasing magnitude. Throughout this period, a growing realisation of the increased flood hazard to the township was confirmed by technical studies. However, no response aside from updating flood hazard maps, and information provision was implemented by local government

until the 1999 flood. This was due to an uncertainty surrounding liability and responsibility issues for large dams, a divided community pursuing and settling compensation cases individually, and a lack of awareness of the degree of increase of the flood hazard.

The 1999 flood inspired a response driven by the CODC and the Alexandra Community Board to gain compensation for flood damages, and to protect the township from the increased flood hazard. This response avoided many of the mistakes made following the earlier floods, and gathered community and political support to gain funding for two parallel studies aimed at building a robust case for compensation to fund protection of the township. The CSC report provided an independent assessment of solutions to the flooding problem over the entire river catchment, while the community driven Future Directions Strategy presented a viable, detailed solution for flooding in Alexandra. Together, these reports gained over \$21 million in compensation, which was used to purchase flood prone properties and construct flood defences to protect the rest of the community.

In Chapter Six, the issues identified from key informant interviews will be discussed and analysed in order to address the research objectives.

## Identification and Analysis of Issues

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From the study of the response to flooding in Alexandra and key informant interviews, several issues important in addressing the objectives of this report have been identified. These are:

- effectiveness of the relevant legislation;
- liability issues concerning natural hazard response;
- local government roles and responsibilities in relation to natural hazards planning;
- perception of the flood hazard in Alexandra;
- response by local government in the Alexandra situation;
- difficulties of responding proactively to increased flood hazards.

These topics range from specific aspects of the legislative framework to the broad field of proactive response by local government. In this manner, a holistic view of the complete hazard management process that has existed in Alexandra, and its implications for other situations can be analysed. These issues are related to the theoretical basis of natural hazards management and discussed in detail below.

### 6.1 Local Government Roles and Responsibilities

#### *6.1.1 Central Otago District Council*

The functions of this local authority were defined as “identifying known hazards and ensuring these are taken into account in Resource Management Act and Building Act

decisions”, and “applying knowledge to practical development applications”. This is an action oriented approach, focussing on land use controls. It was also noted that the District Council bears the economic and social costs of flooding, making this control a pragmatic method of minimising disruption and uncertainty. This role is accomplished through the provision of floodlines on planning maps with related rules and regulations in the District Plan, the maintenance of a district hazards register, and the ability to affix flood hazard warning notes to the Land Information Memorandums (LIMs) of properties considered at risk.

### ***6.1.2 Otago Regional Council***

The role of the Regional Council was seen by those at the District Council and community board levels as that of an expert with technical skills providing relevant data, backed up with regulatory functions defined by legislation. An aspect of this role consists of making technical information available to the District Council, and performing an information verification role on specific sites. Although the responsibility for structural defences for flood protection is stated in the Regional Policy Statement as lying with the ORC, their inability to control the operation of the Roxburgh Dam due to the special enabling legislation that it operates under, and the initial lack of resources, prohibited action. As the settlement following the 1999 flood was negotiated between the Alexandra Community Board and the Crown, the Regional Council is involved only as a ‘mechanism of implementation’ of Crown policy, overseeing the construction of the floodbanks, which are still owned by Contact Energy and the Crown.

There was some criticism of the Regional Council in its fulfilment of these actions, specifically a lack of information provision and hazard mapping. On a general level, the Regional Council’s focus on policy, as opposed to enforceable rules and regulations based on technical grounds, was also mentioned. There was concern that this was resulting in the development of a gap between the two levels of local government, with the land use controls administered by the District Council not fully supported by the Regional Council.



## 6.2 The Effectiveness of Relevant Legislation

### 6.2.1 Introduction

While the natural hazards legislation has been introduced and reviewed in Chapter Three, the effectiveness of this when applied in a real world context must be considered. The case study has allowed study of the application of the Building Act in an area of increasing risk, but as this situation has not involved the granting of subdivision consents in flood prone areas, the effectiveness of Section 106 of the RMA cannot be evaluated in this study.

### 6.2.2 Building Act 1991

The Building Act 1991 states that building consents cannot be refused on flood prone land providing the building does not increase the severity of the problem. The New Zealand Building Code requires the floor level of the structure to be above the 2% A.E.P. level. In the Alexandra situation, an application lodged for a building consent cannot be refused provided floor levels are 300mm above the highest flood level for the site. Interview results clearly showed that this legislation does not give the District Council power to stop a determined developer, and is only effective when the building is likely to accelerate flooding of other properties. The 2% A.E.P. is usually uncertain enough so as to be indefensible to legal challenge. As calculated probabilistic risks will very rarely coincide with past floodlines, especially in areas of increasing risk, the interpretation of these figures are open to dispute when applied to specific sites. This is complicated by the likelihood of periodic increases in this level after each flood event in areas of increasing risk, meaning that this requirement can become ineffectual after a short time period.

The BA provides a process by which councils can be exempted from liability arising from the identified hazard by transferring the risk to the developer. This response was used in the Alexandra situation to encumber the LIM with a flood hazard warning, effectively transferring risk to the owner or developer of the property. This can be viewed as a rather 'lightweight' method of dealing with flood risk, but it prevents the Council, and

hence ratepayers, potentially accepting liability for natural disasters and subsidising those living at risk. While this approach agrees with the interpretation of the Building Act presented by Chapman (1995), it functions by way of a 'market forces' approach where citizens balance their perception and comfort with risk against other factors such as the value of the property.

This situation is brought about by the constraints mentioned in Chapter Two; a lack of resources by local government, a lack of perception of the true nature of the flood hazard, and social resistance to change. With these in effect, the mechanism provided by the Building Act 1991 is favoured. This is interpreted as the Council's method of dealing with liability in a pragmatic manner, where attempting to stop development or require alteration to existing structures may lead to a costly Environment Court case, with no certainty of winning.

### ***6.2.3 Existing Use Rights***

Due to the ability to transfer the risk to building owners, Section 10 of the RMA is not perceived as conflicting with natural hazard management in the Alexandra situation. If a hazard is perceived, or occurs, the LIM is flagged as above, resulting in the same risk transference. From the Council perspective, there is no real concern with the impact of this on property values. As owners should have been aware of the risk before purchasing, or have had the risk transferred to them since owning, the local authority can refuse to take physical action to protect these buildings if it is judged uneconomic or unsustainable. There is little guidance in the international literature or case law to either support or disagree with this approach.

This approach will only change if a sizeable portion of a community, or a valuable part of the area becomes subject to an increased hazard risk, and a large scale response is deemed necessary. This will be decided more by political means and community support than strict discharge of Council obligations.

### 6.3 Liability

Aside from the risk transference in granting building consents as described above, the liability aspect of natural hazard management appears well understood from a pragmatic view. This was a well-discussed topic within the Alexandra response, concerning both the liability and moral obligation of the Crown and Contact Energy, and potential liability concerning the Council's role in the physical response.

Where the main cause for the increased hazard can be identified, as with Contact Energy and the Crown in Alexandra, compensation claims can be directed to these entities. The local authorities in Alexandra had no claims directed at them, even though these were certainly investigated after each flood. The construction of structural defences, such as floodbanks, has not absolved the Crown of its responsibilities for the flooding in Alexandra, and if the defences prove ineffective, the Crown must fund another response. This is the result of negotiations between the Alexandra Community Board and the Crown.

However, where no culpable party can be identified, the Crown will not step in without an obligation to do so. In an 'Act of God' situation, the communities affected will have to cope with this on their own. If the Crown were to respond to each event, this would remove incentives for local government or community response. This differs from Crown funding to relieve social suffering and disruption which is viewed as both a humanitarian and political measure. In this situation, there is no liability should the response carried out by local government fail, unless negligence can be proven in the particulars of the response. Such factors may include indefensible calculations, engineering faults, or failure to take known information into account. However, when unforeseeable natural hazard events occur and when due process is carried out responsibly and is defensible to legal challenge, there is no liability.

### 6.4 Perception of the Increased Flood Hazard

Respondents awareness of the hazard to the township clearly demonstrated an initial dichotomy between community and technical perceptions of the flood hazard that only converged after repeated flooding.

The issue of sedimentation was realised by the Crown long before a dam was considered, and early reports accepted that commissioning a dam would have an effect on flood levels at some point in the future. However, construction proceeded and the issue of an increased flood hazard to Alexandra was largely ignored. At this stage, Central Government departments were calculating the flood levels using a 'fascinating cascade of interpretation' of flood frequency statistics, which showed the risk generally decreasing until the early 1990s. Technical work conducted by the Ministry of Works on the connection between sediment deposition and flood risk was conducted during the late 1970s, but this was not widely recognised among experts until the late 1980s. The District Council was aware of a flood risk during this period, and produced hazard maps showing the highest flood levels from 1993 onwards.

The general community of Alexandra was unaware of this increased flood hazard pre-1994, but when successive floods reached higher levels for the flow volume a perception of an increased risk developed in some sectors of the community.

The two views came together with an investigation on sedimentation by the Otago Regional Council following the 1994 flooding, which provided scientific evidence of a relationship between the two. Recalculation of the flood risk and maximum probable flood levels was conducted by the Regional Council after each of the floods, and at present, due to the wealth of data provided by flooding in the 1990s, the flood risk is judged to be better understood than before (ORC, 2000).

## **6.5 The Physical Response in Alexandra**

The situation in Alexandra is unusual for an increased flood hazard, in that the sole cause was demonstrably the fault of a single development constructed under special legislation passed by Parliament. This allowed the development of a robust case for compensation and future security for the township, and resulted in a total financial package of over \$20 million being paid. This has removed the financial constraints to the response that would be faced by other communities subject to an increased flood hazard.

The section of the response addressing future hazard management (as opposed to compensation and redevelopment of the town) involved purchasing the most severely flood affected buildings, and the erection of structural flood defences on this land with the settlement funding.

Analysed against the flood hazard management theory presented in Chapter Two, this response is a pragmatic combination of structural and non-structural approaches. The CSC report considered purchase of flood prone properties as the most effective single protection mechanism, as it was the quickest and most economic measure, and relieved the social problems caused by the flood hazard. This confirms the effectiveness of 'vulnerability modification' measures, and suggests that with adequate funding and the perception of an increased flood hazard caused by a hazard event, both the financial constraints and social resistance can be overcome on a scale limited to the most affected areas.

Only after this action was taken was the security of the rest of the town considered. However, given that the flood prone properties were owned now by the Crown, it was straightforward to place a measure of structural protection on this land to decrease the risk of flooding considerably. Thus the disrupted areas of the town were used to give the town an added element of security from flooding. This also demonstrates that redevelopment of areas is much easier and more effective following a natural disaster, and allows known concerns to be taken into account.

The effectiveness of this predominantly non-structural action, given the short time required for implementation, was also an advantage when compared with the extent of time required for major river modifications, with extensive water and land use consents being required. This action created a sense of security for the community so that the recovery from the effects of the flood could occur. As Alexandra has a static population level, it is unlikely that intensification of development will occur, establishing the catastrophe potential loop.

## 6.6 The Difficulties of Proactive Response

The optimum time for local government to respond to a perceived increase in risk from a natural hazard in terms of avoiding, remedying or mitigating adverse effects is before a hazard event occurs. Yet for many reasons, it is extremely difficult, if at all possible, for this to be accomplished. The barriers to proactive responses by local government, such as relocation of at risk activities, or construction of structural defences, are described in Chapter Two, and can include:

- social resistance to change;
- lack of awareness of the hazard;
- lack of resources to respond;
- a focus on short term benefits.

This study, through an analysis of the Alexandra situation and key informant interviews, has identified barriers to this response existing within the New Zealand hazard management framework. These are:

- difficulty with identification of the hazard, and defensibility of responses;
- problems with perceptions and understanding of the hazard;
- the available resources for response;
- differing levels of acceptable risk within a community.

These are discussed in detail below.

### 6.6.1 *Hazard Identification*

Gaining the necessary information to identify an increase in a hazard risk, with enough precision to warrant a particular response as both necessary and justifiable, was seen as a major impediment to a proactive response.

This problem has two main facets. The first is having sufficient data to realise that the risk has increased. With recorded flood data on most New Zealand rivers extending back

less than 150 years, a serious problem in predicting the return intervals of extreme events is encountered, as few of these have occurred within this timespan. Even though regional predictions for climate change effects can be made, these usually have inherent uncertainties that preclude accurate translation to specific site hazards. The second factor is the ability to use this information, once obtained, to justify a response that may cause social disruption or require large amounts of funding. It would be extremely difficult to win a defensive action for a regulatory decision in the Environment Court under the current legislative regime without either national direction provided by central government, or explicit enabling legislation. These would allow councils to effectively manage increasing natural hazards without facing disruptive legal action provided they function within statutory bounds.

#### ***6.6.2 Perception and Understanding of the Hazard***

Perception of the hazard, and, more importantly, full understanding of the statistical and probabilistic components of the risk pose a threat to the ability of communities and local authorities to respond. The actual meaning of a 1% A.E.P. flood is not accurately reflected by the term '100 year flood', but this is not apparent without some study of the topic. Common perceptions gained from this include an understanding that once a major flood event occurs, another of the same magnitude will not occur within the return time, or that a major disaster with a high return time will not occur in the short term over which individuals or elected representatives plan. This lack of understanding is reinforced by the general nature of increasing flood hazards. Unlike the Alexandra situation, most natural hazards will increase gradually; a 100% increase in the probability of a 1% A.E.P. flood will double the frequency, so that a flood of this level will have a return period of only 50 years, still beyond the ordinary planning timeframe. This means that even a doubling of the risk associated with a natural hazard does little to inspire a sense of urgency. The short term nature of memories of hazards events, migration of people, and changes in both the organisations responsible for managing natural hazards, and their personnel, can serve to increase the misperception of the true nature of the hazard.

### **6.6.3 Available Resources**

Even if the previous problems are overcome, and the increased natural hazard is identified and properly perceived by both the community and decision makers, the possible response is limited by the resources available to a council. As the burden for natural hazard management falls upon local authorities, this cost must be met by the ratepayer base. For many of New Zealand's smaller townships, this can prove prohibitive; the cost of the Alexandra response is over \$4700 per individual, a totally unaffordable amount in that community. There is also the issue of how this cost should be distributed across the community. Should those at greater risk be required to contribute more? As a community ultimately meets the cost, and must coexist with the consequences of the response, there must be a major community input into the decision-making process, and broad community support for response. These factors raise many questions that must be addressed in situations of increasing risk from natural hazards; Is the community prepared to pay, and, if so, how much? Do they have the will to live and work with their decision and its consequences? The responses to these questions will differ in each situation as the nature and scale of the hazard, the nature of possible responses, and the composition of the community will be different.

### **6.6.4 Differing Levels of Acceptable Community Risk**

How does a diverse community, composed of many different groups, decide on a suitable response that is both fair and equitable? And what right does a local authority have to restrict people's rights to live where they choose if they are prepared to accept the liability in doing so? The main local authority responsibility addressing this issue is the provision of accurate information and education to the community, so that determination of acceptable risk is based on a true and accurate interpretation of known facts, and not on misperception or ignorance of the hazard.



## 6.7 Summary

The main issues concerning local government response to an increasing flood hazard identified from the Alexandra situation have been discussed.

The development of a gap between the Regional Council policy formation role, and the land control functions of the District Council for natural hazards management has the potential to cause a fragmented approach in the future.

Section 36 of the Building Act, while providing some requirement for flood proofing of buildings, is not considered an effective method for preventing building in flood prone areas, and relies on the ability of District Councils to avoid liability by transferring risk acceptance to the developer. Conflict between Section 10 of the RMA and increasing flood hazards is avoided in Alexandra by the use of the same risk transference mechanism as above. This approach is necessitated by constraints on Council resources, and the issue of public expense in protecting private land.

Liability of the Council is not an issue unless it can be shown that it has acted in a negligent manner. The transference of risk removes any obligation for the Council to enact structural defences unless funding is provided by the property owners.

A separation of the flood hazard perception between technical and community viewpoints resulted in Alexandra, due to the lack of investigation of the nature of the risk until flooding occurred. This prevented a true understanding of the hazard emerging earlier, and resulted in a lack of any sense of urgency for a proactive response.

The physical response in Alexandra to the increased flood hazard focussed on the relocation of at-risk inhabitants by purchase of flood prone properties, and use of these to install structural defences to protect the rest of the town. This demonstrates that external funding and the occurrence of a hazard event can overcome the major constraints to vulnerability reduction.

However, several impediments to a proactive response to an increased natural hazard have been identified. These are the ability to accurately identify the increased risk to a

certainty that is defensible in court, a true understanding of the true nature of the hazard, the resources available to fund the response, and the potential for a wide range of acceptable risk within a community.

Chapter Seven provides a synthesis of the body of this report, and presents conclusions concerning the research objectives.

## Conclusion

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### 7.1 Project Aims

The goal of this project has been to investigate the adequacy of the processes provided by current local government legislation by which local authorities can respond to increasing flood hazards in established urban areas. This has been identified as a potential problem in reversing the trend of increasing flood damage to New Zealand towns. The research objectives were:

- i. To determine whether there is conflict between existing use rights under Section 10 of the RMA 199, and planning for increasing natural hazards.
- ii. To assess the current natural hazards management framework in relation to responding proactively to an increased natural hazard.
- iii. To develop recommendations by which local authorities can respond to increased flood hazards.

### 7.2 Research Summary

#### *7.2.1 Flood Hazard Management*

The preceding chapters have defined the nature of flooding as a natural hazard, and reviewed the current paradigms of managing the risk of flooding. The three types of response (modifying the flood, modifying vulnerability, and mitigating damage) have

been investigated with respect to effectively managing increasing natural hazard risk. This has shown that each of these methodologies has barriers that preclude their effectiveness.

Modification of the flood, especially with large scale structural works, while effective in the short to medium term, is ultimately self defeating. Increasing development producing an increased demand for protection, which in turn encourages more intensive development, creates the 'catastrophe cycle' where the potential damage, should the defences fail, is catastrophic. Decreasing the vulnerability to flooding is seen as the most effective measure in reducing damage, but aside from individuals implementing flood proofing of structures and possessions, there are few options available. Large scale relocation or modification of established infrastructure in hazard prone areas is usually too expensive and socially disruptive for most communities to consider. Insurance schemes can be effective in re-establishing affected communities, but only if premiums effectively match the risk posed by the hazard. While they can be used to encourage vulnerability reduction, too often these, and disaster relief schemes, act as a subsidy to those occupying hazard prone sites.

### ***7.2.2 The New Zealand Context***

The historical development of flood management in New Zealand has been described. This demonstrates the genesis of the problem due to the opening up of flood prone land to economically productive uses through structural works, and the reluctance of local authorities to adopt land use controls, which has resulted in many of New Zealand's urban areas now being at risk from increased flood hazards.

A review of the current New Zealand hazard management legislative regime, consisting of the Resource Management Act 1991 and the Building Act 1991 is presented. The RMA provisions are designed to allow the benefits and costs of permitting activities in flood prone areas to be balanced while encouraging the avoidance of unacceptable risks, while the BA is considered more prescriptive and regulatory.

Responsibility for managing natural hazards lies with both Regional and District Councils, and overlaps their respective spheres. Initial confusion over the nature of this overlap appears to have been resolved by enactment of Section 62(ha) of the RMA,

which allows the division of responsibilities to be stated in the Regional Policy Statement. Section 106 of the RMA, and Section 36 of the BA provide legislative tools to control the granting of resource and building consents in hazard prone areas. The BA sets forth a process whereby land subject to a specified natural hazard can be granted a building consent, provided the District Land Registrar is notified and an entry made on the Land Information Memorandum concerning the hazard. Regional and District Plans can also be used to manage natural hazard risk. The provision of information and education concerning the risks of natural hazards, regulatory methods, the establishment of structural event modification works (subject to Section 32 requirements), and the imposition of conditions on subdivision consents are all methods that can be used by local authorities.

However, where existing use rights granted under Section 10 of the RMA stand, there appear to be no mechanisms for local authorities to manage the risk to these created by increasing natural hazards. With no statutory mechanisms or case law to guide councils, there exists a potential difficulty in managing this issue within the limits of available resources. This appears to sit uneasily with the potential for council liability when these activities come into conflict with the increasing frequency and magnitude of natural hazards, and councils are caught between responding proactively and facing problems justifying the necessity of the reaction, and not responding and being subject to legal action should a hazard event occur.

### **7.3 Issue Identification and Analysis**

The applicability of the results drawn from the literature were investigated through a case study of the response by local government in the township of Alexandra, which suffered three major flood events in five years during the 1990s. Through an analysis of the response following the 1999 flood, based on key informant interviews with a range of those involved in this response from a variety of organisations, including the Otago Regional Council, the Central Otago District Council, and the Alexandra Community Board, issues related to the research problem and objectives were identified. These were analysed with respect to how the issues discussed in literature relate to the real world situation.

From this emerged the conclusions related to the research objectives. These are summarised below.

### ***7.3.1 The relationship between local government levels***

A gap between the environmental management functions of Regional Councils, which involve the development of policy as opposed to enforceable technical regulations, and the District Council land control functions was identified. This may result in a fragmented approach to natural hazard management, as a lack of technical support for District Council regulations may hinder the effectiveness of land control measures.

### ***7.3.2 The effectiveness of the relevant legislation***

Section 36 of the Building Act is not considered effective in allowing District Councils to restrict building in flood prone areas, but allows the risk to be transferred from a council to a property owner. This mechanism is used to transfer risk in the case of existing developments, thereby preventing direct conflict with Section 10 of the Resource Management Act. However, this may be considered as incompatible with the requirements of the Resource Management Act for the sustainable management of natural hazards. Strengthening of the legislative requirements for new developments, and the provision of alternatives to local government risk transference are required.

### ***7.3.3 Liability issues***

Liability of local government is not an issue, unless it can be shown that a council has acted in a negligent manner in discharging its duties. This protects local authorities from unpredictable events, yet ensures that their duties are carried out responsibly. Where an external factor can clearly be identified as having caused the increased natural hazard, legal action can be initiated against this entity. However, unless there is provable legal liability, it would be far more effective for affected communities and local authorities to negotiate as a united body to produce an advantageous result.

### ***7.3.4 Perception of increasing hazards***

A dichotomy between technical and community views of the increased hazard in the Alexandra case resulted in misunderstanding of the risk, and a lack of urgency for a proactive, or even post-flood response. Increasing natural hazards must be detected at an early stage to allow for proper investigation, and a community must be informed of the true nature of the risk. This must be accompanied by information and education concerning the causes and effects of the hazard.

### ***7.3.5 An assessment of the Alexandra response***

The response of the Alexandra Community Board and the Central Otago District Council to the increased flood hazard only occurred after the third major flood in five years. This lack of initial action resulted from a fragmented approach in claiming compensation by the community, and arguments over liability between the Crown, Contact Energy, and the Central Otago District Council. It was only after the 1999 flood that a united front was formed, resulting in the appointment of the independent Clutha Solutions Co-ordinator, and the community driven Future Directions Strategy. The recommendations of these resulted in a payment of compensation from the Crown and Contact Energy.

The future flood hazard management component of the response consisted of purchase of the flood prone properties, and the erection of structural defences on this land. This is a pragmatic solution, combining structural and non-structural techniques in order to alleviate the social effects of flooding, and to provide security for the rest of the community against future flooding.

### ***7.3.6 The constraints to proactive response to increased natural hazards***

There are several major constraints to reacting to an increased natural hazard before a hazard event occurs. These are the difficulties in identifying the increased risk to an accuracy that is defensible in court, gaining an understanding of the true nature of the

hazard, the resources available for the response, and the potential for a wide range of acceptable risk within a community.

Of these, only the difficulty of defending interpretations of the increased hazard, and the lack of resources, are directly attributable to the legislative framework within which local government natural hazards planning operates. It is difficult for complex scientific information to be accepted in the Environment Court, where the true nature of the information is not easily understood by the layperson, and frequently conflicts with social and economic factors, which are accorded the same weight (L. Slooten, *pers. comm.*). The lack of resources is due to the devolution of many responsibilities to local government during reforms in the late 1980s, and a lack of recognition of the significance of the research problem by the government. As many communities are unable to fund proactive flood management actions, the damage and disruption caused by increased flooding will continue until an external funding source becomes available.

Understanding by the community and decision makers of the real risk represented by the hazard can be encouraged by local authorities by provision of information, but ultimately this depends on its acceptance by the individual. The wide range of acceptable risks within a single community is a factor that must be dealt with for each different community, but the basic responsibility of local authorities is to define a maximum risk that community members may accept. Ideally, regional councils should be able to define a maximum risk line on the ground, and district councils should be able to implement regulations that effectively prohibit certain activities or building uses below this line.

## 7.4 Summary

This study has analysed the Alexandra response to an increased flood hazard in order to address the research objectives. It has determined that there was no conflict between existing use rights of the RMA and natural hazard management, and has assessed the impediments to responding proactively to an increased natural hazard under the current natural hazard management framework.



The recommendations of this study are presented in Chapter Eight. These will address research objective (iii) by assessing changes required to the legislative framework, the operation of local authorities, and the development of community responses in areas of increased flood hazards to enable effective management.

## Recommendations

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In order to manage the flood hazard in New Zealand in a sustainable manner, and reverse the worldwide trend of increasing damage caused by natural hazards, changes must be made at both central and local government levels.

At central government level, national direction is needed for local government response to increasing natural hazards. Specific actions include:

- While national direction of issues of concern can be provided for by National Policy Statements, the fact that none have been produced in the first ten years of the operation of the RMA demonstrates the difficulty of doing so. The preparation of Ministry for the Environment publications for both local authorities and communities, setting forth national direction on responses while allowing scope for local direction to be incorporated would be a valuable move. These publications may be in the form of guidelines, discussion papers, information papers, reports, and information sheets.
- Amendment to legislation enabling local authorities greater or more explicit powers to respond to increased hazards, by setting out circumstances where this may occur, would increase the legal defensibility of their actions. Tightening the Building Act requirements so that local authorities can implement local restrictions of certain activities in certain circumstances would also be effective.
- Investigate the feasibility of establishing a mechanism for funding, or granting of subsidies, to enable proactive, sustainable flood management programmes. This

should be directed mainly at vulnerability reduction, in order to reduce potential damage and social disruption resulting from increased flooding with a much smaller initial outlay. This would be especially effective in smaller or less affluent communities that are incapable of responding adequately without external funding sources.

- o The development of legislation determining responsibility and liability for the environmental effects of government constructed large dams that have been privatised.

Action is required at the level of local government in order to implement national policy in a manner that encourages sustainability and works towards reversing the trend of increasing natural hazard damage.

- o The establishment of a formal mechanism to prevent a gap opening between regional and district councils with respect to natural hazards. One method of this consists of the development of joint hazard management plans, which combine technical information with land use controls. By containing an explanation of the responses and risks these could be used to encourage community perception and understanding of the hazard risk. The proposed Local Government Amendment Act 2001 makes allowance for consultation between the different levels of local government that is not related to specific developments. This process could be used to ensure that regional and district plans are complementary with respect to Section 10 of the RMA, with district plan rules supported by regional council control over land as per Section 20(2) of the RMA, by means of exercising the functions of Section 30(1)(c)(iv).
- o A tightening of rules and regulations to enforce the restriction of the granting of resource and building consents to at-risk developments. The current 'risk transference' mechanism is interpreted as a failure of existing mechanisms to provide sustainable alternatives that function to reduce the effects of flooding on society.

As the effects of increased flood hazards are likely to be faced only by specific communities in a district, and not over an entire district at any one time, there is a necessity for a community driven response to occur. In order for this to be successful in effectively addressing a hazard, several requirements have been identified from the case study. These are the will to respond, a community driven plan of action, and the resources to implement such a plan.

### o **The Will to Respond**

A reason for a community to implement changes that may cause disruption or involve large expenditures must exist. Unfortunately for a proactive response, the most effective means of providing this is a series of repeated hazard events. In Alexandra, three floods were required for this to occur. Other means of providing a sense of urgency should occur, such as regional council perception of increased hazards through monitoring and technical investigation, or a realisation of the probable consequences of changes in the environment.

### o **A Community Supported Plan of Action**

Once the will to respond has developed, a viable, practicable response must be developed. This must obtain broad community support, which may be problematic in fragmented communities, or in areas where there is some tension between community and council. In areas where this occurs, or where the hazard crosses district or regional boundaries and other councils are involved, an independent position such as that of the Clutha Solutions Coordinator may be contracted to produce an independent, logical report within a limited timeframe; one that provides potential solutions that are acceptable to all parties. Where the solution does not involve this much complexity, a community driven plan such as the Future Directions Strategy would be a more effective use of resources. Such reports, though open to political interference, would provide plans of action in response to increased hazard risk. Depending on the scale and nature of a problem, this might be conducted by the relevant local authority, or an independent specialist. Both of these plans require community involvement and consultation throughout to develop a sense of community ownership and acceptance of

recommendations, and to develop an appropriate balance between the accepted risk and the cost to the community.

### ○ **Resources for Implementation**

As with most actions taken by local authorities, the cost of implementation is a major impediment to proactive response. In Alexandra, funding was available as compensation for the creation of the increased flood hazard, but in other situations the cost of the response must be supported by the community.

This situation has the potential to encourage vulnerability reduction as a response – potentially more effective in preventing damage reduction than structural defences and generating low initial expenses. By discouraging the structural alternative, a community must gain an understanding of the hazard, and develop low cost, effective responses. Relocation of essential services, catchment modification (e.g. tree planting), or community understanding of how to prepare for, or act in, emergencies are all effective actions. By accepting, rather than attempting to avoid, the risk of flooding the catastrophe potential cycle is avoided, and sustainable adjustments to the hazard must be considered.

## **Summary of Recommendations**

- Ministry for the Environment to prepare publications for local authorities and communities, setting forth national direction on responses.
- Legislation amendment enabling local authorities to respond to increased hazards, increasing the legal defensibility of actions, including tightening Building Act requirements to allow for local restrictions.
- Investigate the feasibility of establishing a funding mechanism to enable proactive, sustainable flood management programmes, directed at vulnerability reduction methods.

- Development of legislation determining responsibility and liability for the effects of privatised government constructed large dams.
- Development of joint hazard management plans between regional and district councils, combining technical information with land use controls, to encourage community perception and understanding of the risk.
- Tightening rules and regulations to enforce the restriction of the granting of resource and building consents to at-risk developments.
- When preparing a community based response to an increased flood hazard, conduct a strategy that addresses the three main requirements; the will to respond, a community driven plan of action, and the resources to implement this.

## References

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- Acheson, 1968.** *River Control and Drainage in New Zealand, and some comparisons with overseas practices.* Ministry of Works, Wellington. 295 pgs.
- Alexander, 1993.** *Natural Disasters.* UCL Press, London. 632 pgs.
- Bell, 1999.** *Geological Hazards: Their Assessment, Avoidance and Mitigation.* E&FN Spon, London. 648 pgs.
- Bewick, 1988.** Guidelines for Floodplain Management Planning Studies; Second Draft. *Water and Soil Misc. Pub., No. 29.* National Water and Soil Conservation Authority, Wellington.
- Bewick, 1990.** Resource Management Law and Natural Hazards.  
in Crozier (ed), *Natural Hazards 90: Natural Hazard Assessment in New Zealand.*  
Research School of Earth Sciences, Victoria University, Wellington. 114 pgs.
- Bergham & Westlake, 2001.** Floodplain Management Planning. p43-48. *Tephra, v 18.*  
Ministry of Civil Defence and Emergency Management. Wellington, New Zealand.
- Blakely, 1994.** Natural Hazards and the Resource Management Act; Opening Address to Natural Hazards Management Workshop. p99-108. *Proceedings of the Natural Hazard Management Workshop.* Institute of Geological and Nuclear Sciences Information Series, no. 31.
- Burton, 1965.** Flood-damage reduction in Canada. *Geographical Bulletin*, no. 7, (3-4), p 161-185
- Burton, Kates & White, 1993.** *The Environment as Hazard, Second Edition.* Guilford Press, New York. 290 pgs.
- Central Otago District Council, 1998.** Central Otago Proposed District Plan, Alexandra.
- Changnon, 1998.** The historical struggle with floods on the Mississippi River basin - Impacts of recent floods and lessons for future flood management and policy. *Water International*, 23 (4): 263-271
- Changnon, Kunkel & Andsager, 2001.** Causes for record high flood losses in the central United States. *Water International*, 26 (2): 223-230.
- Chapman, 1995.** *Dangerous Liaisons: legislative change and natural hazard planning in New Zealand.* M. Soc. Sc. Geography and Environmental Planning Thesis, University of Waikato. 158 pgs.

**Christchurch Drainage Board, 1978.** *Environmental Aspects of the Woolston Cut and Associated Stopbanking on the Heathcote River.* Christchurch Drainage Board, Christchurch. 84 pgs.

**Clutha Solutions Coordinator, 2000.** *The Project Seeking Practicable Solutions for the Clutha River System Flooding: Final Report.* 113 pgs.

**Coch, 1995.** *Geohazards: Natural and Human.* Prentice Hall, New Jersey. 481 pgs.

**Cowper, 1995.** Natural Hazard Management and the Law. *Proceedings of the Natural Hazard Management Workshop.* Institute of Geological and Nuclear Sciences Information Series, no. 38.

**Cumberland, 1985.** *Rivers and Lakes in New Zealand.* Whitcoulls, Christchurch. 128 pgs.

**Denscombe, 1998.** *The Good Research Guide: for Small Scale Social Research Projects.* Open University Press, Buckingham, England. 248 pgs.

**Easterling, Meehl, Parmesan, Changnon, Karl & Mearns, 2000.** Climate extremes: Observations, modelling, and impacts. *Science*, 289 (5487): 2068-2074

**Edmonds, Swan & Davidson, 1994.** Natural Hazards and the Law. *Proceedings of the Natural Hazard Management Workshop.* Institute of Geological and Nuclear Sciences Information Series, no. 31.

**Ericksen, 1986.** *Creating Flood Disasters? New Zealand's need for a new approach to urban flood hazard.* Water and soil miscellaneous publication no. 77. Water and Soil Directorate, Ministry of Works and Development. Wellington, New Zealand. 322 pgs.

**Galloway, 1995.** New Directions in Floodplain Management. *Water Resources Bulletin*, 31 (3): 351-357.

**Gardiner, Starosolszky & Yevjevich (eds.), 1995.** *Defence from Floods and Floodplain Management.* Proceedings of the NATO Advanced Study Institute on Defence from Floods and Floodplain Management, Budapest, Hungary, April 26 – May 7, 1994. NATO ASI Series E: Applied Sciences – vol. 299. Kluwer Academic Publishers, Dordrecht, The Netherlands. 568 pgs.

**Gruntfest, 2000.** Nonstructural Mitigation of Flood Hazards. p394-410.  
in Wohl (ed.), 2000. *Inland Flood Hazards.*

**Hinton & Hutchings, 1994.** Regional Councils Debate Responsibilities. *Planning Quarterly*, 114. p4-5.

**Johnstone, 2000.** *The Impact of Sedimentation in Lake Roxburgh on Flood Levels at Alexandra; A Review Following the November 1999 Flood.* Otago Regional Council, Dunedin. 11 pgs.

**Laituri, 2000.** Cultural Perspectives of Flooding. p451-467.  
in Wohl (ed.), 2000. *Inland Flood Hazards.*

**Marco & Cayuela, 1992.** Urban Flooding: the Flood-Planned City Concept. p705-722



in Rossi, Harmancioglu & Yevjevich (eds.), 1992.

**McGee, 1891.** The flood plains of rivers. *Forum*, April, p221-234.

**McKerchar & Pearson, 2001.** Factors causing flooding to be New Zealand's Number One Hazard. p9-15. *Tephra*, v 18. Ministry of Civil Defence and Emergency Management. Wellington, New Zealand.

**Merritts, 2000.** The Effects of Variable River Flow on Human Communities. p271-289. in Wohl (ed.), 2000. *Inland Flood Hazards*.

**Ministry for the Environment, 1999.** *Your Guide to the Resource Management Act: An essential reference for people affected by or interested in the Act.* Draft Document. Ministry for the Environment, Wellington. 69 pgs.

**Ministry of Works and Development, 1985.** *Development in Hazard Prone Areas.* Ministry of Works and Development, Wellington.

**Mitchell, Gardner, Cook & Veale, 1978.** *Physical Adjustments and Institutional Arrangements for the Urban Flood Hazard: Grand River Watershed.* Dept. of Geography, Faculty of Environmental Studies, University of Waterloo, Waterloo, Canada. 142 pgs.

**Moser, 1992.** Assessment of the Economic Effects of Flooding. p515-528. in Rossi, Harmancioglu & Yevjevich (eds.), 1992.

**Mosely & Pearson, 1997.** Preface. pv-vii. in Mosley & Pearson (eds), 1997.

**Mosley & Pearson (eds), 1997.** *Floods and droughts: the New Zealand experience.* New Zealand Hydrological Society, Wellington. 206 pgs.

**Optimix, 2000.** *Future Directions for Alexandra Strategy Study.* Report 80231-10. Optimix, Wellington.

**Opus, 2000.** *Flood History in the Clutha catchment.* Client Report for Contact Energy Ltd., Wellington. 92 pgs.

**Otago Regional Council, 1998.** Regional Policy Statement. Otago Regional Council, Dunedin. 227 pgs.

**Otago Regional Council, 2000.** *Clutha River Catchment November 1999 Flood Report.* Otago Regional Council, Dunedin. 72 pgs.

**Phizacklea, 2001.** Natural Hazard Management in the Tauranga District. *New Zealand Planning Institute; Papers of the Conference 2001, Tauranga 15-17 March 2001.* pg 103-112.

**Pielke, 1999.** Nine fallacies of floods. *Climatic Change*, 42 (2): 413-438.

**Pielke & Downton, 2000.** Precipitation and damaging floods: Trends in the United States, 1932-97. *Journal of Climate*, 13 (20), 3625-3637.

- Reitano, 1995.** Economic Evaluation of Flood Insurance Programs. p445-456.  
in Gardiner, Starosolszky & Yevjevich (eds.), 1995. *Defence from Floods and Floodplain Management*.
- Rice, 2001.** Hazard Management. *New Zealand Planning Institute; Papers of the Conference 2001, Tauranga 15-17 March 2001*. p100-102.
- Rossi, 1992.** Historical Development of Flood Analysis Methods. p11-34.  
in Rossi, Harmancioglu & Yevjevich (eds.), 1992.
- Rossi, Harmancioglu & Yevjevich (eds.), 1992.** *Coping with Floods*. Proceedings of the NATO Advanced Study Institute on Coping with Floods, Erice, Italy, November 3-15, 1992. NATO ASI Series E: Applied Sciences – vol. 257. Kluwer Academic Publishers, Dordrecht, The Netherlands. 775 pgs.
- Sarantakos, 1993.** *Social Research*. MacMillan Education Australia Ltd, Melbourne. 459 pgs.
- Schramm, 1971.** *Notes on Case Studies of Infrastructural Media Projects*. Working Paper, The Academy for Educational Development, Washington DC.
- Sheldon, 1994.** Identifying Natural Hazards and Mitigation and Avoidance Policies. p57-63. *Proceedings of the Natural Hazard Management Workshop*. Institute of Geological and Nuclear Sciences Information Series, no. 31
- Smith & Ward, 1998.** *Floods: Physical Processes and Human Impacts*. John Wiley & Sons Ltd, Chichester, England. 382 pgs.
- Soil Conservation & River Control Council, 1968.** *Annual Report*, Appendix to the Journals of the House of Representatives.
- Stewart & Kamins, 1993.** *Secondary Research: Information Sources and Methods*. Applied Social Research Methods Series Volume 4. Sage Publications, California. 158 pgs.
- Thomas, 1995a.** Principles of Floodplain Management. p257-270.  
in Gardiner, Starosolszky & Yevjevich (eds.), 1995.
- Thomas, 1995b.** United States Experience with Floodplain Management. p359-372.  
in Gardiner, Starosolszky & Yevjevich (eds.), 1995.
- Ward, 1978.** *Floods: A Geographical Perspective*. Focal Problems in Geography Series. Macmillan, London. 244 pgs.
- Waugh, Freestone & Lew, 1997.** Historic floods and droughts in New Zealand. p29-50.  
in Mosley & Pearson (eds), 1997.
- White, 1973.** Natural Hazards Research. p193-216.  
in Chorely (ed). *Directions in Geography*. Methuen & Co Ltd, London. 331 pgs.
- Wohl, 2000.** Inland Flood Hazards. p3-27.  
in Wohl (ed.), 2000. *Inland Flood Hazards*.

**Wohl (ed.), 2000.** *Inland Flood Hazards*. Cambridge University Press, New York. 498 pgs.

**Yevjevich, 1992.** Floods and Society. p3-10.  
in *Rossi, Harmancioglu & Yevjevich (eds.), 1992.*

**Yevjevich, 1995.** Operation of Flood-affecting Structures for Optimal Floodplain Management. p249-256.  
in *Gardiner, Starosolszky & Yevjevich (eds.), 1995.*

**Yin, 1993.** *Applications of Case Study Research*. Applied Social Research Methods Series Volume 34. Sage Publications, California. 131 pgs.

**Yin, 1994.** *Case Study Research: design and methodology (second edition)*. Applied Social Research Methods Series Volume 5, California. 170 pgs.

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## Newspaper Articles

All articles from the Otago Daily Times (ODT).

Duggan, 1994a. ODT 11/1/94

Duggan, 1994b. ODT 29/1/94, ECNZ to study impact of silt on Alexandra flood.

Duggan, 1995a. ODT 16/12/95. River 1.9m above 1994 flood level.

Duggan, 1995b. ODT 19/12/95. Flood cause inquiry supported.

Duggan, 1999. ODT 17/2/99, Council may sue Crown for flood money.

Fridd, 1995. ODT 14/12/95, 'Flood-proofing' water, sewerage systems pays off

Fridd, 1995a. ODT 15/12/95, Flood recedes in Alexandra

Fridd, 1996a. ODT 3/2/96. Contact Energy to be billed for damage by flood.

Fridd, 1996b. ODT 28/3/96. Contact 'prepared to talk'.

Galer, 1994. ODT 18-1-94, Clutha River flood at Alexandra largest on record, authorities say.

King, 1994. ODT 10/1/94, Storms wash out roads, disrupt holiday plans.

King, 1999. ODT 18/11/99, Hundreds of residents evacuated.

O'Connor, 1997a. ODT 1/7/97, Alexandra flood row diminishes as many claims reach settlement.

Smith, 1999. ODT 10/4/99, \$420 000 settlement in Central flood row.

Stevens, 1995a. ODT 14/12/95, Swollen rivers rekindle '94 memories.

Worrall, 1994a. ODT 11/1/94, Four houses under water.

Worrall, 1994b. ODT 30/4/94, Build-up of sediment a major cause of flooding – joint study

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## Relevant Legislation and Cases

**Building Act 1991**

**Local Government Amendment Act 1979**

**Resource Management Act 1991**

River Boards Act 1884

River Boards Act 1908

Soil Conservation and Rivers Control Act 1941

Town and Country Planning Act 1953

Town and Country Planning Amendment Act 1966

Town and Country Planning Act 1977

Water and Soil Conservation Act 1967

Water and Soil Conservation Amendment Act 1973

**McKinlay vs. Timaru District Council, 2001.** Environment Court, Decision No. C24/2001.

**Application by Canterbury Regional Council, 1995.** Planning Tribunal, Decision No. A 89/94

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### Electronic Media

Ministry for Emergency Management, 2000. <http://www.mem.govt.nz/memwebsite.nsf>

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### Personal Communications

*Dave Whitney*, Consultant Planner, Johnson Whitney Ltd., Alexandra.

*Dr. Liz Sooten*, Course Director, Environmental Science Programme, University of Otago.

# Appendix 1

## Key Informants

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Alex Adams	Clutha Solutions Coordinator.
Dave Whitney	Consultant Planner, Alexandra.
Malcolm Macpherson	Alexandra Community Board District Councillor, Central Otago District Council.
Daphne Hull	Alexandra Community Board (Chair) Deputy Mayor, Central Otago District Council.
Bob McNeil	Planning & Development Manager, Central Otago District Council.
Graeme Martin	Chief Executive, Otago Regional Council.

# Appendix 2

## Interview Issues and Questions

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### Issues to be discussed:

- How can councils in NZ respond to increased hazards in a sustainable way?
- Does the current resource management regime provide support and tools?
- Case study of Alexandra response to increased flood hazard.
- Understanding of local government responsibilities
- Perception of the increased hazard
- Response to the IFH
- General natural hazard management
- Liability issues

### Main Topics

#### *Institutional roles and responsibilities*

- Organisations understanding of its own roles and responsibilities
- Organisations understanding of others roles and responsibilities
- Have either of these understandings changed as the extent of Alexandra's new flood hazard was understood?*

#### *Response to the increased hazard*

- What was (your organisations) role in planning the response to the hazard?
- What options were considered?
- How was the final course of action decided on?
- What problems can you see with the current response?
- Do you feel that the tools available to (your organisation) were sufficient to deal with the flood hazard?

### ***Perception of the hazard***

When was the increased flood hazard perceived?

At what stage did the (organisation) accept that a response had to be made?

Was this response driven by expert or community pressure?

### ***General hazard management***

Do you see increasing natural hazards as an important issue in the future?

What do you think this is driven by?

Are the current controls on new development in flood-prone areas effective enough?

Will there be a conflict between existing development and natural hazards?

Is the current hazard management regime in NZ sufficient to deal with this problem?

If not, what changes could be made?

### ***Liability Issues***

What do organisations understand about liability issues and culpability?

## **Questions**

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### **Regional Council**

What does the RC see as its role in natural hazard planning in Otago?

What about the role of District Councils?

What does the RC understand as its duties in respect to the increased flood hazard in Alexandra?

- when the increased risk was perceived
- long-term actions

How about the duties of the CODC in Alexandra?

- when the increased risk was perceived
- long-term actions

Do you think that the flooding in Alexandra has caused a change in the role of, or the understanding of the role of any of these?

What was the RCs role in planning the response to the hazard?

What options were considered by the RC?

How did this fit in with the CODCs response?

How did you decide on the present response? What were the main factors?

Can you see any limitations or potential problems with the current response?

Do you think that the tools and mechanisms available to RCs were sufficient to deal with the Alexandra problem?

What about for DCs?

Do you think that the Clutha Solutions Coordinator position was necessary or effective?

Do you see natural hazards as an increasingly important issue in the future?

What do you think this is driven by?

Are the current controls on new development in flood-prone areas effective enough in controlling natural hazards?

Can you see a conflict between existing development and natural hazards in the future?

Is the current hazard management regime in NZ sufficient to deal with this problem?

If not, what changes could be made?

At what stage was it realised that the flood hazard had increased?

At what stage did the RC realise that a response had to be made?

Was this response driven by expert or community pressure?

Are you aware of any liability should a structural work fail, causing flooding damage?

Are there any other liability issues regarding natural hazards that concern the RC?

## **District Council**

What does the DC see as its role in natural hazard planning?

What about the role of the Regional council?



What does the DC understand as its duties in respect to the increased flood hazard in Alexandra?

- when the increased risk was perceived
- long-term actions

How about the duties of the RC in Alexandra?

- when the increased risk was perceived
- long-term actions

Do you think that the flooding in Alexandra has caused a change in the role of, or the understanding of the role of any of these?

What was the DCs role in planning the response to the hazard?

Have any land use planning regulations changed as a result of the IFH?

What options were considered by the DC?

How did you decide on the present response? What were the main factors?

How did this fit in with the RCs response?

Can you see any limitations or potential problems with the current response?

Do you think that the tools and mechanisms available to DCs were sufficient to deal with the Alexandra problem?

What about for RCs?

Do you think that the Clutha Solutions Coordinator position was necessary or effective?

Do you see natural hazards as an increasingly important issue in the future?

What do you think this is driven by?

Are the current controls on new development in flood-prone areas effective enough in controlling natural hazards?

Can you see a conflict between existing development and natural hazards in the future?

Is the current hazard management regime in NZ sufficient to deal with this problem?

If not, what changes could be made?

At what stage was it realised that the flood hazard had increased?

At what stage did the DC realise that a response had to be made?

Was this response driven by expert or community pressure?

Are you aware of the liability should a structural work fail, causing flooding damage, or flood damage occur in an area approved for building?

Are there any other liability issues regarding natural hazards that concern the DC?

## **Community Board**

Is the increased flood hazard in Alexandra something that should have been dealt with at local government level?

Why did the community board end up negotiating with Central Government?

Is this something that you think the Regional or District Council should have done?

What do you understand as the role of the RC in this situation?

Do you think that they fulfilled their role effectively?

What about the DCs role?

Do you think that they fulfilled this role effectively?

With three '100-year' floods, when do you think action should have been taken?

How effective or necessary do you think the Clutha Solutions Coordinator position was?

How acceptable to the community would 'managed retreat' or relocation of Alexandra be?

What level of risk would be acceptable to the community? Should individuals be able to choose the flood risk they take?

Do you think that Alexandra will continue to be at risk from flooding?

Will local government be prepared for the next flood?

Where do you think liability should fall, if a structural work fails, or flood damage occur in an area approved for building?

Are there any other liability issues regarding natural hazards that concern the ACB?

What is the role of Central Government in: responding to natural hazard events? planning proactively for natural hazards?

Given that the damage potential of natural disasters is increasing, who bears the main responsibility for the situations given above?